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# Appendix BB

# Baseline Ecological Risk Assessment

# BASELINE ECOLOGICAL RISK ASSESSMENT REPORT

Benning Road Facility
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## List of Acronyms

| | |
|---|---|
| μg/goc | micrograms per gram organic carbon |
| μg/L | Micrograms per liter |
| μmol/g$_{oc}$ | micromole per gram organic carbon |
| AHR | Aryl hydrocarbon receptor |
| ARSP | Anacostia River Sediment Project |
| AUF | Area Use Factor |
| AVS | Acid Volatile Sulfide |
| BAZ | Bioactive Zone |
| BERA | Baseline Ecological Risk Assessment |
| BHC | Hexachlorocyclohexane |
| B-IBI | Benthic Index of Biotic Integrity |
| BTV | Background threshold value |
| CBR | Critical Body Residue |
| cm | centimeter |
| COPC | Constituent of Potential Concern |
| CSM | Conceptual Site Model |
| DOEE | District of Columbia Department of Energy and Environment |
| DDD | Dichlorodiphenyldichloroethane |
| DDE | Dichlorodiphenyldichloroethylene |
| DDT | Dichlorodiphenyltrichloroethane |
| DO | Dissolved Oxygen |
| DOC | Dissolved organic carbon |
| dw | dry weight |
| ED | Exposure Duration |
| EPC | Exposure Point Concentration |
| EqP | Equilibrium Partitioning |
| ERA | Ecological Risk Assessment |
| ESB | Equilibrium Partitioning Sediment Benchmark |
| ESV | Ecological Screening Value |

| | |
|---|---|
| FCV | Final chronic value |
| $f_{oc}$ | fraction organic carbon |
| HMW | High Molecular Weight |
| HOC | Hydrophobic organic compounds |
| HQ | Hazard Quotient |
| LMW | Low Molecular Weight |
| LOAEL | Lowest Observed Adverse Effect Level |
| LOEC | Lowest Observed Effects Concentration |
| MDE | Maryland Department of Environment |
| mg/kg | milligrams per kilogram |
| mg/$kg_{bw}$/day | milligram per kilogram body weight per day |
| mg/L | milligrams per liter |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanographic and Atmospheric Administration |
| NOAEL | No Observed Adverse Effect Level |
| NOEC | No Observed Effect Concentration |
| PAH | Polycyclic Aromatic Hydrocarbon |
| PCBs | Polychlorinated Biphenyls |
| PEC | Probable effect concentration |
| PEC-Qs | Probable effect concentration quotients |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |
| RI/FS | Remedial Investigation and Feasibility Study |
| RPD | Relative percent difference |
| SEM | Simultaneously Extracted Metals |
| SPI | Sediment profile imagery |
| SQuiRT | Screening Quick Reference Table |
| SSQL | Sample-Specific Quantitation Limit |
| SVOC | Semivolatile Organic Compound |
| TCDD | Tetrachlorodibenzo-p-dioxin |
| TDD | Total Daily Dose |
| TEQ | Toxic equivalence |

| | |
|---|---|
| TOC | Total Organic Carbon |
| tPCBs | Total PCBs |
| TRV | Toxicity Reference Value |
| TU | Toxic unit |
| UCL | Upper Confidence Limit |
| UET | Upper Effect Threshold |
| USACE | U.S. Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Services |
| VOC | Volatile Organic Compounds |
| WOE | Weight of evidence |
| WQS | Water Quality Standards |
| ww | wet weight |

# 1 Introduction

AECOM Technology Services (AECOM) has prepared this Baseline Ecological Risk Assessment (BERA) on behalf of the Potomac Electric Power Company and Pepco Energy Services, Inc. (collectively "Pepco") as part of a Remedial Investigation/Feasibility Study (RI/FS) for Pepco's Benning Road facility, located at 3400 Benning Road NE, Washington, DC. The Study Area for the RI/FS consists of the facility property (the Landside Investigation Area) and an adjacent segment of the Anacostia River (the Waterside Investigation Area).

The BERA was conducted to evaluate the potential for risks to ecological receptors in the Waterside Investigation Area. A Preliminary BERA for the Study Area was submitted to the District of Columbia Department of Energy and Environment (DOEE) in April 2015 and finalized in response to DOEE comments in February 2016 (AECOM, 2016a). The Preliminary BERA was based on field sampling activities completed between January 2013 and December 2014. Following the submittal of the Preliminary BERA, additional field investigations were determined to be necessary to address remaining data gaps and uncertainties. The Phase II field investigation was described in the RI/FS Work Plan Addendum 3 (AECOM, 2016b) and the risk assessment work plan was presented in *Technical Memorandum #3: Baseline Human Health and Ecological Risk Assessment Work Plan Addendum* (AECOM, 2016c). The Phase II field investigations were conducted in the spring and summer of 2017. This BERA incorporates the results of both the Preliminary BERA and the results of the additional 2017 field investigation.

A Draft Final RI Report was finalized in September 2019. The Draft Final RI Report was made available for public comment from October 4, 2019 through December 6, 2019. This Final BERA incorporates the public comments received during the comment period.

The Study Area for the RI/FS is shown on **Figure 1-1**. This BERA focuses solely on the evaluation of potential risks to ecological receptors in the Waterside Investigation Area. As indicated in **Figure 1-2**, the Waterside Investigation Area encompasses approximately 38 acres of the Anacostia River extending from approximately 1,000 linear feet downstream of the Benning Road Bridge to approximately 1,000 linear feet upstream of the cove in the Waterside Investigation Area where the Benning Facility's main stormwater outfall discharges (depicted as Outfall 013 on **Figure 1-2**).

The primary objective of this BERA is to evaluate whether ecological receptors are potentially at risk at the population level due to exposure to chemical stressors within the Waterside Investigation Area. This assessment of potential ecological risks includes analysis of spatially and temporally co-located sediment chemistry, pore water sediment profile imagery (SPI), macroinvertebrate community abundance, and toxicity testing data collected during the Waterside Investigation Area field sampling program. The Waterside Investigation Area Phase II field program, which was conducted in May and June of 2017, focused on collection of abiotic media samples, and did not include any Study Area-specific tissue residue sampling and analysis. Surficial sediment samples and biota tissue samples collected by DOEE in support of the Anacostia River Sediment Project (ARSP; Tetra Tech, 2018) were also evaluated in this BERA (DOEE data selected for inclusion in this BERA is described in Section 2).

### 1.1 Preliminary BERA Summary

A Preliminary BERA was submitted to DOEE in April 2015 and finalized in response to DOEE comments in February 2016 (AECOM, 2016a). This Preliminary BERA was based on field sampling activities completed between January 2013 and December 2014. The Preliminary BERA concluded the following:

- Based on a screening level risk analysis presented in the Preliminary BERA, there is low potential for risk to the benthic macroinvertebrate community from exposure to Constituents of Potential Concern (COPCs) in surficial sediments in the Waterside Investigation Area, and the potential for risks are limited to the vicinity of the Waterside Investigation Area Cove (referred to hereafter as "Cove").
- Many of the risks to the benthic macroinvertebrate community in the Waterside Investigation Area are similar to risks posed by surficial sediments at the Site-specific background sampling locations where the COPC concentrations are similar.
- A screening level analysis of fish tissue data collected by the United States Fish and Wildlife Service (USFWS) and the Maryland Department of the Environment (MDE) at sampling locations within the reach of the Anacostia River extending upstream and downstream of the Waterside Investigation Area showed no potential for ecological risks to the fish community based on COPC concentrations.
- There is no potential for ecological risks to the wildlife community from exposure to COPCs in the Waterside Investigation Area.

Following the submittal of the Preliminary BERA, additional field investigations were determined to be necessary to address remaining data gaps and uncertainties. This BERA incorporates the results of both the Preliminary BERA and the additional 2017 field investigation. In addition, the BERA includes whole body fish (and invertebrate) tissue samples collected by DOEE in support of the ARSP (Tetra Tech, 2018) instead of the USFWS and MDE fish tissue dataset described above (data included in this BERA are further described in Section 2).

### 1.2 Ecological Risk Assessment Guidance and Methodology

The general approach for this BERA was presented in Technical Memorandum #3 (AECOM, 2016c) of the Final RI/FS Work Plan Addendum (AECOM, 2016b).

The BERA was conducted according to the tiered approach and methodology provided in the United States Environmental Protection Agency (USEPA) *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment, Interim Final* (USEPA, 1997), *Guidelines for Ecological Risk Assessment* (USEPA, 1998), and *The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments* (USEPA, 2001).

The BERA was designed based on USEPA's eight-step ecological risk assessment process (USEPA, 1997) in which COPCs identified in Steps 1 and 2 are retained for further investigation for specific receptors/pathways in Steps 3 through 8 (**Figure 1-3**). Conducting assessments in a tiered, step-wise manner allows the risk assessor and risk manager to maximize the use of available information and sampling data, while providing the opportunity to reduce the uncertainties inherent in the BERA process through the use of focused supplemental data collection to fill key data gaps identified in the previous tier of the assessment. Scientific Management Decision Points occur at key points in the process and are used by the risk assessor and risk manager to determine if the process should continue, or if enough data have been evaluated to determine the outcome of the BERA.

In accordance with the USEPA guidance and process documents, the principal components of the BERA include:

- **BERA Problem Formulation**: In this phase, the objectives of the BERA are defined (which were defined in the Work Plan Addendum and reiterated in this document), and a plan for characterizing and analyzing risks is determined. Available information regarding stressors and Study Area-specific receptors is evaluated to develop assessment endpoints and the BERA Conceptual Site Model (CSM).
- **BERA Risk Analysis**: During the risk analysis phase of work, data are evaluated to characterize potential ecological exposures and effects.

- **BERA Risk Characterization**: During risk characterization, exposure and stressor response profiles are integrated through risk estimation. Risk characterization also includes a summary of uncertainties, strengths, and weaknesses associated with the risk assessment.

These three components are conceptually sequential. However, the risk assessment process is frequently iterative, and new information brought forth during the risk characterization phase, for instance, may lead to a review of the problem formulation phase, or additional data collection and analysis. The results of the BERA will be used to help inform the need for any additional evaluation and/or remedial action at the Waterside Investigation Area, and will also help inform the Natural Resource Damage Assessment process.

As detailed in the Work Plan, the Waterside Investigation Area BERA integrates a variety of lines of evidence (LOEs) to assess potential ecological risks. A weight of evidence (WOE) approach was used to synthesize conclusions regarding overall potential risks to ecological receptors by considering the results of all components of the assessment methodology (i.e., the approach was designed to integrate the results of physical, biological, toxicological, and field measurement endpoints to draw risk-based conclusions). The WOE components were designed to provide relative measures of potential risks for different ecological receptors and exposure pathways.

### 1.3 Report Organization

The following sections present a summary of the BERA components:

- **Section 2** presents the data that were considered in this BERA, which include Site-specific data collected by Pepco and relevant data collected by DOEE to support the ARSP. This section also presents the data quality assessment and treatment.
- **Section 3** presents the BERA problem formulation, which was used to determine the focus and scope of this BERA and includes the identification of ecological receptors and potentially complete exposure pathways in the Waterside Investigation Area. Assessment endpoints and the CSM were developed in the Problem Formulation Statement.
- **Section 4** presents the BERA risk analysis. This section presents the characterization of potential exposure and potential effects on ecological receptors that may be exposed to Anacostia River sediment, including warmwater fish, benthic invertebrates, and vertebrate wildlife.
- **Section 5** presents the BERA risk characterization. This section presents the evaluation of the likelihood of adverse effects associated with exposure to the Site-related chemical stressors (i.e.,

COPCs) and discusses the significance of the BERA results in the context of the urbanized Anacostia River corridor.

- **Section 6** presents the uncertainty evaluation, which discusses the assumptions of the BERA process that may influence the risk assessment results and conclusions.
- **Section 7** presents the summary and conclusions of the BERA.

# 2 Data Considered in the BERA

This section presents a summary of the data included in the BERA and describes how these data were treated and summarized. Pepco conducted field investigations in the Waterside Investigation Area (**Figure 2-1**) in 2013 and 2017 as part of the Phase I and Phase II RI and as described in the RI Work Plan (AECOM, 2012) and the RI/FS Work Plan Addendum 3 (AECOM, 2016b). Sampling and analysis activities are described in detail in Section 2 of the Phase II RI report. The dataset for the BERA included all sediment and pore water sampling data collected during Phase I and Phase II. Surface water and groundwater were not further evaluated in this BERA because no ecological risks were found for these media in the Preliminary BERA. In addition, surficial sediment samples collected by DOEE in support of the ARSP from locations within the Waterside Investigation Area or upstream areas of the river were included in the Waterside Investigation Area and background datasets, respectively. The combined Pepco and DOEE surficial sediment datasets include a total of 84 surface sediment samples from 69 locations in the Waterside Investigation Area, as well as 54 background samples from 54 background sampling locations. As described further in Section 2.5.1 below, whole fish and invertebrate data collected by DOEE were also included in the dataset for the BERA. The number and sources of samples collected are summarized below.

| Source of Data | Number of Samples | |
|---|---|---|
| | **Waterside Investigation Area** | **Background** |
| **Sediment** | | |
| Pepco – Phase I RI | 46 | 6 |
| Pepco – Phase II RI | 17[a] | 5[a] |
| DOEE Phase I and Phase II ARSP | 21 | 39 |
| Total Sediment Samples | 84 | 54 |
| **Tissue** | **ARSP Exposure Unit 3 & Kingman Lake** | **Background** |
| DOEE Whole Body Fish Tissue | 42[b] | 76 |
| DOEE Invertebrate | 13 | -- |

Notes:
-- Indicates no invertebrate samples from the background area were included.
(a) The Pepco Phase II RI Site and background sediment samples, collected at 15 Site locations and five background locations, are co-located with sediment samples collected for the sediment bioassay, macroinvertebrate survey, and pore water analyses.
(b) Fish tissue samples were collected at locations in the ARSP Exposure Unit 3 and Kingman Lake outside of the Waterside Investigation Area boundary (i.e., no fish tissue samples were collected at locations within the Waterside Investigation Area) (See Section 2.5).

**Tables 2-1** (surficial sediment)**, 2-2** (pore water)**, 2-3** (fish tissue)**,** and **2-4** (invertebrate tissue) provide the date and source of samples and analyses per sample included in the BERA. **Figure 2-1** displays the sediment sample locations within the Waterside Investigation Area, and **Figure 2-2** displays the background sediment sample locations. Analytical data included in the BERA are presented in **Attachment A** and summary statistics are presented in **Attachment B**.

### 2.1 Pepco 2013 Sediment Data

Pepco collected Phase I RI sediment samples at 46 locations in the Waterside Investigation Area and at 10 Site-specific background sampling locations between November 5, 2013 and January 31, 2014. Surface sediment grab samples were collected from a depth of 0 to 15 centimeters (cm) (0 to 0.5 feet [ft]) below sediment surface using a Petite Ponar grab sampler. All samples were analyzed for total organic carbon (TOC), grain size, metals, simultaneously extracted metals (SEM), acid volatile sulfides (AVS), Polychlorinated Biphenyl (PCB) Aroclors, and 16 Polycyclic Aromatic Hydrocarbons (PAHs). A sub-set of samples was analyzed for Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), pesticides, and dioxin/furans.

The sediment samples collected for the Phase I RI, along with the sediment samples collected for the Phase II RI (Section 2.2) and the DOEE sediment data (Section 2.4), for a total of 84 samples, were included in the Sediment Benchmark Screening (Section 4.1).

### 2.2 Pepco 2017 Sediment and Pore Water Data

Pepco collected additional Waterside Investigation Area surface sediment samples during Phase II in June 2017. Surface sediment samples were collected at 17 locations in the vicinity of the Cove. These locations were co-located with the 17 stations sampled during the Phase I Waterside Investigation Area RI to achieve a broad concentration range and spatial coverage of the Waterside Investigation Area in Phase II. Additionally, background surface sediment samples were collected from five upstream locations. All samples were analyzed for TOC, grain size, metals, SEM and AVS, PCB Aroclors, VOCs, SVOCs, pesticides, and dioxin/furans. A sub-set of samples were analyzed for PCB congeners.

Background surface sediment sample locations and data are presented in the Background Evaluation (Appendix W of the RI Report). The selection of the upstream Site-specific background locations is addressed in Technical Memorandum #2 which was approved by DOEE on October 14, 2016. Pepco performed further analysis of potential tidal influence to confirm that all sediment sampling locations included in the Site-specific background dataset were upstream of any potential influence from the Site. The details of the analysis and the results are provided in Appendix W of the RI Report. The net sediment transport direction was determined to be southerly. An incoming tide during a low river flow event would present the worst case condition for the mobilization and upstream transport of fine-grained sediments where fines (silt and clay) from the Cove could potentially be carried upstream with the tide and then settle out from the water column during slack tide. Pepco's analysis indicated that the background location SEDBACK 20 and the background locations upstream of SEDBACK 20 will not be influenced by any Site-related contaminants as a result of tidal exchanges. No sampling locations downstream of SEDBACK 20 were included in the background sediment sample dataset for the purpose of calculating Site-specific background values.

Pore water samples were collected at 15 locations in the vicinity of the Cove and five upstream background locations; these samples were collected synoptically with surficial sediment from these locations. Pore water samples were analyzed for metals, PAHs, PCBs, dissolved organic carbon (DOC), and hardness. The pore water samples are presented in detail in **Table 2-2**.

The sample depth for the Phase II surface sediment and pore water samples was 0 to 10 cm (approximately 4 inches or 0 to 0.33 ft). This sample depth was selected based on the results of the SPI Reconnaissance Survey conducted at the 15 near-Site locations in the vicinity of the Cove and five upstream background locations. Based on signs of biogenic activity (e.g., gas voids) in the sediment and observations of infauna, the SPI survey results indicated that the depth of the bioactive zone (BAZ) in this portion of the river is 0 to 10 cm, which is consistent with the BAZ reported for most estuarine and freshwater tidal environments (USEPA, 2015a). The SPI Survey report is presented in **Attachment C**, along with DOEE communications approving the use of the 10 cm BAZ sampling depth at the Waterside Investigation Area.

As described in Section 2.1, the surface sediment samples collected for the Phase II RI were included in the Sediment Benchmark Screening (Section 4.1) with the sediment samples collected for the Phase I RI (Section 2.1) and the DOEE sediment data (Section 2.4), for a total of 84 samples. The Phase II RI sediment samples were also used for the benthic macroinvertebrate community risk analysis (Section 4.2) and are co-located with the sediment bioassay and benthic macroinvertebrate community samples described in Section 2.3.

### 2.3 Sediment Bioassay and Benthic Macroinvertebrate Community

Surficial sediment samples collected at 15 Waterside Investigation Area locations (**Figure 2-1**) and five upstream background locations (**Figure 2-2**) were submitted for sediment toxicity testing in the laboratory for the amphipod (*Hyalella azteca*; 10-day exposure), midge (*Chironomus dilutus*; 10-day exposure), and benthic macroinvertebrate community analysis. These samples were collected using the same grab sampling techniques for bulk sediment chemistry from the designated 10 cm BAZ. The sediment bioassay and benthic macroinvertebrate community samples were used for the benthic macroinvertebrate community risk analysis (Section 4.2) and are co-located with the Phase II RI sediment samples (Section 2.2).

## 2.4 DOEE Sediment Data

The data collected by Pepco were supplemented with data collected by Tetra Tech on behalf of DOEE for the ARSP, which are reported in the ARSP RI Report (Tetra Tech, 2018). Twenty-one samples from the ARSP surface sediment dataset were collected within the Waterside Investigation Area in 2014, 2015, and 2016 (**Figure 2-1**) from a depth of 0 to 0.5 ft below sediment surface. The selection of the background surface sediment samples and locations from the ARSP dataset is discussed in the Background Evaluation (Appendix W of the RI Report). These background locations are shown on **Figure 2-2**. The DOEE samples included in the BERA sediment dataset are presented in **Table 2-1**. The 21 sediment samples collected by DOEE were used in the Sediment Benchmark Screening (Section 4.1) along with the sediment samples collected for the Phase I RI (Section 2.1) and Phase II RI (Section 2.2), for a total of 84 samples.

Pore water samples were also collected by Tetra Tech (2018) to support the ARSP, but these pore water data for organic constituents were not included in the pore water dataset in this BERA because they were collected and analyzed using different techniques from those used by Pepco, which resulted in datasets that were not directly comparable. Passive sampling techniques using sorbents such as polyethylene sheets or polydimethylsiloxane on solid phase microextraction fibers (the methods used by Pepco) are regarded by USEPA and academia as the best available techniques to measure truly dissolved concentrations of hydrophobic organic compounds (HOCs) such as PAHs and PCBs in pore water (Ghosh et al., 2014; Lydy et al., 2014; USEPA, 2012; USEPA, 2017; Hawthorne et al., 2005). Results from traditional centrifugation and whole water extraction of supernatant water (the methods used by DOEE) can include HOCs on colloidal solids or attached to dissolved macromolecular natural organic matter. Given the extremely low water solubility of some HOCs, results from these traditional methods can be orders of magnitude higher than the truly dissolved fraction that is most relevant to risk assessment based on the bioavailability and chemical activity of the HOCs in pore water. Combining results from these very different methods would be inappropriate because they are not comparable datasets. The sampling and analyses for inorganic COPCs were comparable between Pepco and Tetra Tech pore water data sets, and boxplot comparisons of Site and background datasets presented in the Background Evaluation (Appendix W of the RI Report) illustrate that metals concentrations in the Pepco and Tetra Tech pore water data sets are similar.

## 2.5 DOEE Fish and Invertebrate Tissue Data

In accordance with the approved RI/FS Work Plan (AECOM, 2012), biota samples were not collected during this program (AECOM, 2012, 2016b), and tissue data available from the ARSP were evaluated to determine whether they were relevant and appropriate to include in this BERA. The following sections describe the fish and invertebrate data from the ARSP that were included in this BERA.

### 2.5.1 Fish Tissue Data

Fish tissue samples were collected by Tetra Tech on behalf of DOEE in 2014 and 2015 to support the Anacostia River Sediment Project (Tetra Tech, 2018). No fish tissue samples were collected in the Waterside Investigation Area, so a series of conservative assumptions were made to allow consideration of ARSP data in this BERA. Tetra Tech divided the lower Anacostia River into six exposure units. The Waterside Investigation Area is located in Exposure Unit 3. Whole body fish tissue samples used in the BERA were collected from within Exposure Unit 3, which includes samples collected from an area ranging from approximately 1.4 miles upstream of the Waterside Investigation Area to New York Avenue and approximately 1.4 miles downstream to the CSX bridge (2.8 miles total), including Kingman Lake (East Capitol Bridge to Amtrak Bridge). The habitat of Kingman Lake differs from the main stem of the river with slower moving water and shallower water depths. However, because there are no fish barriers between the mainstem of the river and Kingman Lake, fish may move between these two areas and the Waterside Investigation Area. Statistical comparisons of constituent concentrations detected in forage fish tissue samples collected in EU3 and Kingman Lake were conducted using two-sample hypothesis tests in ProUCL (version 5.1) and the results indicated that there are no statistically significant differences in tissue concentrations between the two areas.[1] Therefore, both Exposure Unit 3 and Kingman Lake fish tissue samples are included in this BERA (**Figure 2-3**). The results of the statistical comparisons of EU3 and Kingman Lake forage fish tissue concentrations are summarized below.

| COPC | FOD | | Median (mg/kg) | | Distribution[(a)] | | Two-sample Test[(b)] | |
|---|---|---|---|---|---|---|---|---|
| | EU3 | Kingman Lake | EU3 | Kingman Lake | EU3 | Kingman Lake | p-value | Outcome |
| Lead | 6:6 | 9:9 | 0.45 | 0.83 | Gamma | Normal | 0.08 | EU3 = KL |
| Nickel | 6:6 | 9:9 | 0.63 | 0.72 | Normal | Normal | 0.36 | EU3 = KL |
| Mercury | 3:6 | 2:7 | 0.07 | 0.06 | Normal | Normal | 0.23 | EU3 = KL |
| Zinc | 6:6 | 9:9 | 37 | 37 | Normal | Approx. Normal | 0.61 | EU3 = KL |
| Total PCB Congeners | 6:6 | 9:9 | 321 | 334 | Normal | Normal | 0.91 | EU3 = KL |
| 4,4'-DDE | 6:6 | 9:9 | 17 | 19 | Normal | Normal | 0.45 | EU3 = KL |

[1] The ProUCL output files are provided in **Attachment B**.

| COPC | FOD | | Median (mg/kg) | | Distribution[a] | | Two-sample Test[b] | |
|---|---|---|---|---|---|---|---|---|
| | EU3 | Kingman Lake | EU3 | Kingman Lake | EU3 | Kingman Lake | p-value | Outcome |
| Endrin | 6:6 | 9:9 | 4.3 | 5.3 | Normal | None | 0.77 | EU3 = KL |
| Chlordane | 6:6 | 9:9 | 140 | 130 | Normal | Normal | 0.51 | EU3 = KL |
| Heptachlor epoxide | 6:6 | 9:9 | 4.3 | 3.2 | Normal | Normal | 0.26 | EU3 = KL |

Notes:
FOD – Frequency of Detection (number of detected concentrations: total number of samples)
KL – Kingman Lake
(a) The distribution of the EU3 and KL datasets were determined using the Shapiro-Wilks test (significance level 0.05) in ProUCL 5.1. Non-detect values were represented by the full value of the reporting limit.
(b) Two-sample hypothesis tests were conducted in ProUCL 5.1. Parametric t-tests were conducted if both datasets were normally distributed with no non-detects. Non-parametric tests were conducted if one or both datasets were not normal (Wilcoxon-Mann-Whitney) and included non-detects (Tarone-Ware). The null hypothesis is the means or central tendencies of both sample sets are not statistically different ($p > 0.05$: fail to reject $H_o$).

Whole body fish tissue samples collected by Tetra Tech downstream of the CSX bridge and upstream of New York Avenue were included to represent fish tissue concentrations downstream and upstream of the Waterside Investigation Area, respectively. For forage fish with smaller forage or home ranges, these upstream and downstream tissue samples may be representative of regional fish tissue concentrations. For upper trophic level fish with larger home ranges, there is likely overlap in exposure among sampling areas (i.e., these fish likely move throughout the lower Anacostia River and do not necessarily only represent exposure in Exposure Unit 3 or Kingman Lake). The upstream and downstream tissue samples are also illustrated on **Figure 2-3** and detailed in **Table 2-3**.

Forage fish and mid-trophic level fish samples were used to represent fish as prey in the food chain model. Lower trophic level (forage) fish, mid-trophic level fish, and upper trophic level (predator) fish samples were used to represent fish for the critical body residue evaluation. A total of 42 whole body composite fish tissue samples are available in Exposure Unit 3 and Kingman Lake (**Table 2-3**) and include the following species.

| Trophic Level Tissue Sample | Species |
|---|---|
| Forage fish | Banded killfish, bluegill, creek chubsucker, eastern silvery minnow, green sunfish, golden shiner, pumpkinseed, redbreast sunfish, spottail shiner, tessellated darter, white perch |
| Mid-level trophic fish | Bluegill, pumpkinseed |
| Top-level or predator fish | Black crappie, largemouth bass |

Source: Tetra Tech, 2018

As noted above, none of the fish tissue samples were collected from within the Waterside Investigation Area (Figure 2-3). As a result, it is uncertain if the samples reflect exposure to sediment in the Waterside

Investigation Area, particularly for fish with limited homes ranges. In addition, although it is assumed that fish may accumulate constituents through direct contact with sediment or dietary uptake of the sediment (small forage fish with limited home ranges in particular), the significance of sediment as a source relative to other sources (e.g., surface water, prey tissue) is uncertain. Additional discussion on the sediment to fish tissue relationship is presented in CSM discussion (Section 3.4) and uncertainty evaluation (Section 6.2).

### 2.5.2 Invertebrate Tissue Data

Benthic invertebrate tissue data sets were collected by Tetra Tech on behalf of DOEE to support the Anacostia River Sediment Project (Tetra Tech, 2018). The 13 invertebrate tissue samples used in the food chain model were collected from within Exposure Unit 3 as described above for fish tissue (**Figure 2-3**) and include composite samples of crayfish, snail, and clam (**Table 2-4**). Six invertebrate tissue samples were collected in the Waterside Investigation Area at locations just north of the Benning Road Bridge, and the remaining samples were collected within Exposure Unit 3 upstream and downstream of the Waterside Investigation Area and in Kingman Lake. The invertebrate tissue samples were included in the wildlife community risk analysis (Section 4.4) as a dietary source for great blue heron and raccoon.

## 2.6 Data Quality Assessment

The data collected as part of the RI program were validated by project chemists as specified in the Quality Assurance Project Plan (QAPP) (AECOM, 2012). All project data from laboratory chemical analyses were validated using criteria specified in the approved QAPP, the relevant EPA reference methods, and EPA's *National Functional Guidelines for Inorganic and Organic Data Review* (USEPA, 2008a). Note that the data quality assessment performed as part of the Benning Road RI did not include the tissue data collected by other parties. Tetra Tech conducted Phase 2B validation of the fish tissue data sets collected by DOEE (Tetra Tech, 2018).

The laboratory quality control (QC) results, specified as laboratory deliverables in the QAPP, were reviewed. The method-specific QC results included method blanks, equipment blanks, laboratory control samples, matrix spikes, matrix duplicates, laboratory duplicates, field duplicates, and/or surrogates, and were summarized on QC forms, where applicable. Additional method-specific parameters and the laboratory report narratives, which detail all QC non-conformances, were also reviewed with regard to any potential impacts to the sample data usability.

Qualifiers were applied to the data where applicable due to QC non-conformances. Upon completion of the data validation of each data set, data validation reports summarizing the sample delivery groups and parameters reviewed and any QC non-conformances were prepared. In addition, the reports summarize the qualifiers applied to the data as a result of any non-conformances noted during the validation process. Data validation reports for each data set are included in Appendix Q of the RI Report. A summary of the data validation and project quality assurance assessments is provided in Section 4.1 of the RI Report. Overall, more than 99% of the data reviewed was found to be reliable and acceptable for use in risk assessment and remedial decision-making.

### 2.6.1 Data Treatment

Exposure point concentrations (EPCs) were estimated within each medium of interest for each COPC in order to evaluate the potential exposures to ecological receptors. These EPCs represent the range of media concentrations that ecological receptors may encounter. Average and maximum EPCs were considered in the food chain evaluation and in the comparison of historic and recently collected sediment and pore water concentration data against benchmarks. The maximum EPC is the upper confidence limit (UCL) on the arithmetic mean, or the maximum when UCLs cannot be calculated due to data limitations (i.e., insufficient number of samples or number of detected results). The selected EPCs are presented in **Attachment B**. Toxicity testing and macroinvertebrate community data were evaluated on a sample-by-sample basis (i.e., summary statistics were not used to evaluate concentration-response trends relative to these lines of evidence).

All analytical data were compiled and tabulated in a database for statistical analysis. When a sample and a duplicate pair were collected, they were treated as one sample for the calculation of summary statistics (including maximum detection and frequency of detection). When a constituent was detected in both the sample and the duplicate, the higher concentration was used.[2] When both the sample and the duplicate were not detected, the higher of the sample-specific quantitation limits (SSQLs) was used. When one of the pair was reported as not detected and the other was detected, the detected concentration was used.

USEPA's ProUCL Version 5.1 software (USEPA, 2016) was used to calculate UCLs on the arithmetic mean according to USEPA guidance (USEPA, 2002). When non-detects were present, the Kaplan-Meier method was used (using SSQLs and appropriate substitution methods). The ProUCL-recommended UCLs (i.e., 95%, 97.5%, 99%) were used as the selected UCL. Based on information presented in the ProUCL guidance (USEPA, 2015b) regarding minimum sample size and frequency of detection, UCLs and Kaplan-Meier means were calculated when at least 10 samples and at least six detected results were available. While ProUCL version 5.1 recommends a minimum of 10 samples with six detected values to calculate reliable UCLs, the guidance recognizes that this may not always be possible due to resource or

[2] In the Preliminary BERA, duplicates were averaged. DOEE requested that the samples be evaluated based on relative percent difference (RPD) and, to use the average when the RPD is less than or equal to 25% and the maximum when the RPD is greater than 25%. To simplify, the maximum was conservatively used in this BERA.

other restraints, and allows the analyst to use best professional judgment when determining the validity of the calculations.

The following summary statistics were calculated:

- **Frequency of Detection:** The frequency of detection is reported as the number of samples reported as detected for a specific constituent and the total number of samples analyzed. The total number of samples reflects the treatment of duplicates discussed above.
- **Maximum Detected Concentration:** This is the maximum detected concentration for each constituent/area/medium combination.
- **Minimum Detected Concentration:** This is the minimum detected concentration for each constituent/area/medium combination.
- **Mean Detected Concentration:** This is the arithmetic mean concentration for each constituent/area/medium combination based on detected results only.
- **Kaplan-Meier Method Mean:** When non-detects are present in the data set, the mean concentrations was derived by the program using appropriate SSQL substitution methods (USEPA, 2015b).
- **UCL:** This is the UCL recommended by ProUCL version 5.1. If more than one UCL was recommended by the program (i.e., 95%, 97.5%, 99%), the higher UCL was selected.
- **Maximum EPC:** The lower of the selected UCL and the maximum detected concentration were selected.
- **Average EPC:** This is the arithmetic mean for data sets with no non-detects. The Kaplan-Meier Method mean was used for data sets with non-detects, except when the Kaplan-Meier mean could not be calculated due to an insufficient number of detects, then the arithmetic mean of the detected results was selected.

### 2.6.2 Calculation of Totals

The following totals were calculated for both Pepco and DOEE datasets. Total PCBs were calculated for each sample by summing the detected individual PCB Aroclors or congeners. If no individual PCB Aroclors or congeners were detected, the total concentration was flagged as non-detected (U-qualified) with a reporting limit equal to the maximum reporting limit of the individual PCB Aroclor or congener.

Total PAHs, total High Molecular Weight (HMW) PAHs, and total Low Molecular Weight (LMW) PAHs were calculated for each sample by summing the detected individual PAH compounds for each total. If no individual compounds were detected, the total concentration was flagged as non-detected (U-qualified) with a reporting limit equal to the maximum reporting limit of the individual PAH compound.

The toxic equivalence (TEQ) was calculated for each sample for the group of dioxins and furans, which are structurally and toxicologically related to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). The World Health Organization's 2005 (Van den Berg et al. 2006) mammalian toxic equivalency factors, which were adopted by USEPA (2008b), were used to calculate a toxicity-weighted concentration for each of the dioxin and furan congeners. For each sample, the TCDD-TEQ total was calculated by summing the toxicity-weighted concentration for each detected congener (non-detected congeners were treated as zeros). If none of the congener results within the toxicity-weighted total was detected, the total was flagged as non-detected (U-qualified) with the TCDD-TEQ value equal to the highest toxicity-weighted reporting limit.

# 3 BERA Problem Formulation

The BERA Problem Formulation provides the framework for the BERA and serves to define the risk assessment objectives and the geographic area to be considered. It also identifies the ecological receptors, exposure pathways, and endpoints to be evaluated.

The risk assessment objective for the BERA is to evaluate whether or not populations of ecological receptors (e.g., benthic macroinvertebrates, warmwater fish, birds, and wildlife) are potentially at risk due to exposure to Site-related constituents in the sediments within the Waterside Investigation Area.

The BERA Work Plan Addendum identified the ecological receptors, the exposure pathways, and the biological endpoints to be considered in the BERA. These topics are summarized in the following sections, and the CSM is presented in **Section 3.4.**

## 3.1 Site Description and Ecological Setting

The following descriptions of the Waterside Investigation Area, and specifically the potential ecological receptors and habitats associated with the Waterside Investigation Area, are based on previous Site investigations, including an ecological site assessment conducted in 2013. No major changes have occurred in the Waterside Investigation Area since 2013.

### 3.1.1 Waterside Investigation Area Description

The Waterside Investigation Area encompasses approximately 38 acres of the Anacostia River and extends from approximately 1,000 linear feet downstream of the Benning Road Bridge to approximately 1,000 linear feet upstream of the Cove (**Figure 1-2**).

The Benning Road facility was identified as a suspected source of contamination along the Anacostia River, and is one of 14 properties along the tidal Anacostia River currently identified by DOEE as potential environmental cleanup sites (Tetra Tech, 2018). Most of the stormwater from the facility is discharged to the Anacostia River from Outfall 013 located in the Cove along the east bank of the river within the Waterside Investigation Area. Outfall 013 was also the authorized discharge point for cooling tower blowdown and cooling tower basin wash water when the cooling towers were in operation.[3] There are also two non-Pepco outfalls located next to Outfall 013 (photodocumentation of these outfalls is

[3] Pepco ceased operations at the Benning Road Power Plant effective June 1, 2012.

presented in the RI Report). A second outfall, Outfall 101, receives stormwater runoff from inlets in the southwest corner of the Benning Road facility. Outfall 101 also received stormwater collected in secondary containment basins for transformers associated with the power plant when the plant was in operation. The transformers and their containment areas were demolished and removed as part of the power plant demolition.

### 3.1.2 Ecological Setting

The Waterside Investigation Area is located in the Anacostia River, approximately 4.7 river miles upstream from the confluence with the Potomac River. This portion of the river is a freshwater estuary, and tidal influence extends upstream of the Waterside Investigation Area into the northwest and northeast branches of the river. The river is slow-moving with low flow velocities and high sedimentation rates (2.8 to 7.1 centimeters per year [Velinsky et al., 2011]).

The Waterside Investigation Area includes riverine aquatic habitat and wetland habitat that offers resources for a variety of species. An evaluation of species observed or potentially present in the area was completed for the Preliminary BERA based on the following sources: AECOM personnel during a December 2013 ecological site assessment and additional field activities in 2014 through 2015, Anacostia Watershed Toxics Alliance (AWTA, 2002), USFWS surveys, and United States Geological Service (USGS) Patuxent Wildlife Research Center (a summary is presented in **Attachment D**). Aquatic species present in the vicinity of the Waterside Investigation Area include algae, aquatic (water-dwelling) and benthic (sediment-dwelling) invertebrates, fish, and aquatic birds. The mammal community present included a variety of species known to occur in urban areas (e.g., raccoon [*Procyon lotor*]). Emergent wetland plant species were dominated by common reed (*Phragmites australis*) and cattail (*Typha* sp.), and riparian vegetation was dominated by large trees and shrubs consisting of maple, oak, and sycamore.

AECOM consulted with the DOEE, USFWS Chesapeake Bay Field Office, and the National Oceanographic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) to determine if any federally listed species or other sensitive receptors exist at or in the vicinity of the Waterside Investigation Area. Agency responses were received in January 2015. Responses indicated no federally listed or proposed threatened or endangered species were present in the vicinity of the Waterside Investigation Area. In addition, DOEE responded that no listed or sensitive species or communities were present.

DOEE presented a summary of biological resources in the tidal Anacostia River in the *Phase II Ecological Risk Assessment* (Tetra Tech, 2018) based on many of the same sources above and information gathered by DOEE in support of the Phase I and Phase II Ecological Risk Assessments (ERAs). The following additional information was gleaned from DOEE's observations:

- **Aquatic Plants**: Submerged aquatic vegetation is limited throughout the river, but pockets of emergent vegetation are present.
- **Aquatic Invertebrates**: Based on the results of a survey conducted by DOEE with passive sampling devices (Hester-Dendy Samplers), the benthic and epibenthic macroinvertebrate communities were dominated by chironomids, amphipods, oligochaetes, gastropods, bivalves, caddisflies, and mayflies.
- **Fish**: Lowest trophic level fish (i.e., forage fish) in the river are dominated by minnows (Cyprinidae) and killifish (Fundulidae), mid-trophic level fish are dominated by sunfish (*Lepomis* spp.), and upper-trophic level (i.e., predator fish) are dominated by catfish (Ictaluridae) and largemouth and smallmouth bass (*Micropterus* spp.).

### 3.2 Identification of Receptors and Potentially Complete Exposure Pathways

USEPA (1997, 1998) defines a complete exposure pathway as "one in which the chemical can be traced or expected to travel from the source to a receptor that can be affected by the chemicals." Therefore, in order for a complete exposure pathway to exist, a chemical, a migration pathway, a receptor, and mechanisms of toxicity of that chemical must be demonstrated.

Potentially complete exposure pathways for ecological receptors were identified through a review of documents and reconnaissance of the Waterside Investigation Area for the Preliminary BERA and were re-evaluated for this BERA. Potentially relevant pathways were identified for groups of ecological receptors based on potential sources of COPCs, an environmental medium (e.g., surface water or sediment), and a potential exposure route to relevant receptors. Incomplete routes of exposure were not evaluated in the BERA. This approach was used to focus the risk evaluation on exposure pathways that are considered to be potentially complete and for which there are adequate data pertaining to the receptors, exposure, and toxicity for completion of the risk analysis.

Based on the results of the Preliminary BERA, river sediment is the primary medium of potential ecological concern within the Waterside Investigation Area. Surface water and groundwater exposure routes were ruled out in the Preliminary BERA. This focus on river sediment and sediment pore water for ecological pathways is supported by the results of other recent investigations on Anacostia River sediment. For example, Ghosh et al. (2019) investigated the movement of contaminants between sediment and freely dissolved phase and bioaccumulation in biota and preliminary findings suggest concentrations in the freely dissolved phase are reflective of those in mussel tissue.

Potentially complete exposure pathways were determined to exist for benthic macroinvertebrates, fish, and piscivorous wildlife (e.g., birds and mammals). The Preliminary BERA found little to no evidence of Site-related risks to fish and wildlife, which is likely related to the small size of the Waterside Investigation Area relative to the much larger size of the foraging and home ranges for these species throughout the river. However, per DOEE request, these receptors are evaluated in the BERA based on the recently collected sediment data. Therefore, the BERA evaluated the following ecological exposure pathways:

- Direct contact with surface sediment and pore water by benthic macroinvertebrates
- Direct contact with surface water (i.e., respiration or surface water flowing across gills) and ingestion of abiotic media (i.e., sediment) and contaminated food sources by warmwater fish
- Ingestion of contaminated prey items (i.e., fish) and abiotic media (i.e., sediment) by selected vertebrate wildlife receptors (i.e., piscivorous birds and mammals)

### 3.3 Identification of Assessment Endpoints and Measurement Endpoints

Ecologically based assessment and measurement endpoints were designed to evaluate potential ecotoxicological effects associated with exposure to identified COPCs. According to USEPA (1998), assessment endpoints are formal expressions of the actual ecological value to be protected. They usually describe potential adverse effects to long-term persistence, abundance, or production of populations of key species or key habitats. Typically, assessment endpoints and receptors are selected for their potential exposure, ecological significance, economic importance, and/or societal relevance.

Because assessment endpoints often cannot be measured directly, measurement endpoints are selected that generally relate to the assessment endpoints. Measurement endpoints are measures of effect that yield a quantitative metric for evaluating potential effects of constituents on the ecosystem components potentially at risk (USEPA 1997, 1998); examples of measurement endpoints include comparison of media concentrations to screening levels or concentrations of COPCs in tissue to critical body residues (CBRs). Since each measure of effect has intrinsic and extrinsic strengths and limitations, several measures of effect were used to evaluate each assessment endpoint.

The assessment and measurement endpoints selected for the BERA are based largely on the Preliminary BERA, and in some cases include comparisons to background conditions. The endpoints include the following:

- **Assessment Endpoint 1** – Protection and maintenance of freshwater benthic invertebrate populations in aquatic habitats within the Anacostia River typical of comparable aquatic habitats with similar morphology, hydrology, and urban setting.
    - **Measurement Endpoint 1a** – **Comparison of sediment concentrations to literature-derived sediment screening values**. Concentrations above the screening values were considered indicative of a potential for ecological risks. Comparisons between Waterside Investigation Area sediment concentration data and background sediment data were used to distinguish between Site-related and system-wide (e.g., anthropogenic and natural background) conditions.
    - **Measurement Endpoint 1b – Characterization of bioavailability potential of divalent metals in sediment based on SEM and AVS relationships.** A SEM/AVS ratio greater than 1 in a sediment sample is considered an indicator of potential bioavailability for divalent cationic metals. The SEM and AVS difference (SEM-AVS) normalized to the organic carbon content was also considered in this evaluation for which thresholds of 130 micromoles per gram organic carbon (μmol/$g_{oc}$) to 3,000 μmol/$g_{oc}$ were used to indicate toxicity based on the bioavailability of divalent metals.
    - **Measurement Endpoint 1c – Comparison of Waterside Investigation Area and background area sediment toxicity bioassays.** Survival and growth of macroinvertebrates measured in Waterside Investigation Area sediment were compared to survival and growth of macroinvertebrates measured in background sediment to evaluate the potential lethal and sub-lethal effects associated with exposure to sediment.
    - **Measurement Endpoint 1d – Comparison of Waterside Investigation Area and background benthic invertebrate communities.** Benthic macroinvertebrate community metrics measured in Waterside Investigation Area sediment were compared to metrics measured in background sediment to evaluate the potential chemical and physical stressors associated with Waterside Investigation Area sediment.
    - **Measurement Endpoint 1e – Comparison of pore water concentrations to literature-derived surface water screening values.** Concentrations above the screening values were considered indicative of a potential for ecological risks and used to evaluate the Site-specific toxicity and macroinvertebrate data.
    - **Measurement Endpoint 1f – Characterization of bioavailability potential of PAHs in sediment based on the Equilibrium Partitioning (EqP) Sediment Benchmark guidance for PAH mixtures in sediment and pore water.** In sediment, concentrations of individual PAHs

are normalized by the sample-specific organic carbon content, then divided by the chemical-specific endpoint (final chronic value [FCV]) to generate a PAH-specific toxic unit (TU). In pore water, concentrations of individual PAHs are divided by the chemical-specific endpoint (FCV) to generate a PAH-specific TU. In both sediment and pore water, PAH-specific TUs are summed per sample. A TU sum less than 1 indicates no toxicity to benthic invertebrates.

- **Assessment Endpoint 2** – Protection and maintenance of fish communities in aquatic habitats within the Anacostia River typical of comparable upstream aquatic habitats with similar morphology, hydrology, and urban setting.
  - **Measurement Endpoint 2a – Comparison of fish tissue COPC concentrations to available CBR thresholds and background tissue concentrations.** Fish tissue residue concentrations were compared to no-effect and lowest-observed-effect CBRs. Qualitative comparisons between tissue residue concentrations from near-Site river reaches and the river reaches located downstream and upstream were used to evaluate regional (e.g., anthropogenic and natural background) conditions.
- **Assessment Endpoint 3** – Protection and maintenance of a piscivorous vertebrate wildlife community in aquatic and wetland habitats within the Anacostia River typical of comparable aquatic habitats with similar morphology, hydrology, and urban setting.
  - **Measurement Endpoint 3a – Comparison of calculated potential daily doses for avian and mammalian receptors from exposure to bioaccumulative COPCs in abiotic media (surface water and sediment) and ingestion of contaminated prey items (fish and invertebrates) to constituent-specific toxicity reference values (TRVs).** Estimated doses above the TRVs were considered indicative of a potential for ecological risks. Qualitative comparisons between tissue residue concentrations from the samples collected in the Study Area and tissue residue concentrations from the river reaches located downstream and upstream were used to evaluate regional conditions (both anthropogenic and natural background).

### 3.4 Ecological Conceptual Site Model

After the problem formulation step is completed, the ecological CSM can be developed or refined. The CSM describes how the COPCs might pose hazards to the ecosystem and ecological receptors at the Waterside Investigation Area. The CSM (presented in **Figures 3-1a** and **3-1b)** provides a schematic representation of the potential constituent release mechanisms, the exposure pathways, and potential ecological receptors assessed in the BERA.

As depicted in the CSM, there are a number of potential exposure pathways by which ecological receptors may be exposed to media of interest.

- Benthic invertebrates are exposed to contaminants in sediment and surface water through direct contact and ingestion. The benthic invertebrate measurement endpoints in this BERA (described under Assessment Endpoint 1 in Section 3.3) are focused on data from the Cove of the Waterside Investigation Area, which was identified as the area with the greatest range and highest concentrations of sediment concentrations in the Phase I BERA.

- Fish and wildlife are exposed to contaminants in sediment and surface water through ingestion and direct contact (including respiration), and are also exposed to contaminants through consumption of prey (as described in Assessment Endpoints 2 and 3, respectively, in Section 3.3) in the Waterside Investigation Area and in the river outside of the Study Area in which these receptors move and forage.

As noted in earlier sections, fish, birds, and mammals have been found on and in the vicinity of the Study Area. However, due to the relatively small size of the Waterside Investigation Area, most fish, birds and mammals are unlikely to reside and forage solely on the Study Area. Therefore, although fish and wildlife risks are considered in this BERA, much of the focus of the BERA is on potential impacts on lower trophic level receptors associated with the river sediment (i.e., benthic invertebrates).

Further, although fish and invertebrate tissue data from the ARSP RI were included in this BERA for the fish community and wildlife community evaluations, per the direction of DOEE, these data were collected by DOEE to evaluate overall conditions in the Anacostia River. It is unknown if the fish tissue samples collected in Exposure Unit 3 and Kingman Lake reflect conditions in the Waterside Investigation Area or simply reflect the several-mile-long river reach that was sampled. It is assumed that fish may accumulate constituents through direct contact with sediment or dietary uptake of the sediment or prey, but the uncertainties of this relationship are significant and difficult to quantify (these uncertainties are further addressed in Section 6.2). In contrast, given the small range of mobility of benthic organisms, relative to more mobile fish species that likely move throughout the river, it is reasonable to assume that the ARSP invertebrate tissue samples collected within the Waterside Investigation Area or just outside of the Study Area in Exposure Unit 3 and Kingman Lake are representative of exposure concentrations for fish and wildlife prey items within the Study Area.

Potentially complete pathways identified for benthic invertebrates and fish include incidental ingestion of and dermal or direct contact with sediment and pore water. Potentially complete pathways for wildlife include incidental ingestion of sediment and ingestion of contaminated prey (i.e., fish) from the Anacostia River.

# 4 BERA Risk Analysis

The risk analysis phase of the BERA is based on the CSM developed during problem formulation (Section 3.4) and entails the characterization of potential ecological exposures and effects. The ecological exposure assessment involves identifying potential exposure pathways and evaluating the magnitude of exposure to identified ecological receptors. The ecological effects assessment describes the potential adverse effects associated with ecological receptor exposure to the identified COPCs and reflects the type of assessment endpoints selected. The methodology and data used to identify and characterize ecological exposure and effects for each assessment endpoint are described in the following sections.

## 4.1 Sediment Benchmark Screening

The bulk sediment benchmark screening was based on the full sediment dataset consisting of both Pepco and DOEE samples in the Waterside Investigation Area (84 samples; presented in **Table 2-1** and on **Figure 2-1**). COPCs were identified for sediment by comparing maximum detected constituent concentrations to low-effect ecological screening values (ESVs) that are protective of ecological receptors (e.g., benthic and aquatic invertebrates, fish). Any constituent for which the maximum detected concentration in sediment exceeded its respective low-effect sediment ESV was identified as a COPC. The presence of COPCs in environmental media at concentrations above the ESVs does not necessarily constitute ecological risk; only that additional evaluation is warranted.

Sediment chemistry analysis results were compared to available low-effect and probable-effect ESVs selected using a hierarchy of the following sources:

- Freshwater sediment values, presented by NOAA in the Screening Quick Reference Tables (SQuiRTs) (Buchman, 2008)
- USEPA Region 3 Freshwater Sediment Screening Benchmarks (USEPA, 2006)
- USEPA Region 4 Sediment Screening Values (USEPA, 2018)

Low-effect ESVs selected from Buchman (2008) were typically the Threshold Effect Level or Threshold Effect Concentration from MacDonald et al. (2000) or USEPA Region 4 ecological sediment screening values (USEPA, 2018). Probable-effect ESVs were typically the Upper Effect Threshold (UET) from Buchman (1999 as cited in Buchman [2008]), Severe Effect Level from Persaud et al. (1993), or the

Refinement Screening Value for Step 3a (USEPA, 2018). Sediment ESVs used in this BERA are presented in **Table 4-1**.

The full sediment dataset consisting of both Pepco and DOEE samples in the Waterside Investigation Area (presented in **Table 2-1**) was included in the sediment benchmark screen. The results of the sediment COPC identification process are presented in **Table 4-2**. The following COPCs were selected:

- 13 metals: antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc
- 13 pesticides: 4,4'- dichlorodiphenyldichloroethane (DDD), 4,4'- dichlorodiphenyldichloroethylene (DDE), 4,4'- dichlorodiphenyltrichloroethane (DDT), aldrin, cis-chlordane, chlordane (technical), trans-chlordane, dieldrin, endosulfan sulfate, endrin, endrin ketone, heptachlor epoxide, and methoxychlor
- Total PCB Aroclors and total PCB congeners
- Eight SVOCs: 4-chloroaniline, 4-methylphenol, benzaldehyde, benzoic acid, bis-(2-ethylhexyl)phthalate, butylbenzylphthalate, carbazole, di-n-octylphthalate
- Total HMW PAHs, Total LMW PAHs, and Total PAHs (via two methods: 8270 and ID0016)
- Cyanide

In addition, the following COPCs were identified because no sediment ESVs were available: three metals (beryllium, thallium, and vanadium); two SVOCs detected via method 8270 (acetophenone and caprolactam); three SVOCs detected via method ID0016 (2,3,5-trimethylnaphthalene, 2,6-dimethylnaphthalene, and perylene), and 17 dioxin/furan compounds. Consistent with the Preliminary BERA, essential nutrients were not identified as COPCs.

Consistent with the Preliminary BERA, the individual PAHs and PCB Aroclors listed in **Table 4-2** were screened. However, these compounds were evaluated further as the sum of individual detected compounds. In general, individual PAHs and PCB Aroclors all exhibit a similar mode of toxicity to many ecological receptors and are often evaluated as total PAHs or PCBs, respectively, for evaluating ecological risk. Total PAHs and total PCBs were calculated as the sum of the detected individual PAHs or PCB Aroclors in a sediment sample. The potential for individual PAHs to be bioavailable at concentrations that may pose a risk were investigated in more detail based on EqP theory (Section 4.2.5).

## 4.2 Benthic Macroinvertebrate Community Risk Analysis

Benthic organisms may potentially be exposed to COPCs from direct contact with sediment or pore water. Several measures of effect were used to evaluate the assessment endpoint developed for the benthic macroinvertebrate community in the Waterside Investigation Area. The potential for risks to the benthic community from exposure to COPCs in sediment was evaluated using a weight-of-evidence approach, whereby multiple lines of evidence (e.g., sediment benchmark screening, SEM and AVS, PAH bioavailability analysis, toxicity testing, macroinvertebrate community survey, pore water) were evaluated. The evaluation of Site-specific factors was based on 15 sediment samples collected in 2017 by Pepco in the Waterside Investigation Area in which co-located samples were collected for each analysis listed above. The five upstream background samples (also collected in 2017 by Pepco) were included in this evaluation as well. A Background Evaluation (presented in Appendix W of the RI Report) was also conducted on sediment samples collected by Pepco and DOEE upstream of the Waterside Investigation Area (presented in **Figure 2-2**) and is discussed in Section 5.

### 4.2.1 Evaluation of Divalent Metals Bioavailability

SEM, AVS, and TOC were measured in the 15 samples collected from the Waterside Investigation Area and from five upstream background locations in 2017 to better understand the bioavailability of divalent metals in sediment (**Table 4-3**). The potential for binding to sulfides was evaluated by reviewing the SEM:AVS ratios and the differences between the SEM and AVS concentrations (i.e., SEM minus AVS). Sediments with SEM:AVS ratios less than 1 typically have sufficient metal binding capacity to maintain dissolved metals concentrations in the pore water below toxic levels. When the SEM:AVS molar ratio is less than 1, according to the USEPA briefing report to the USEPA science advisory board (USEPA, 1995), “in virtually no instance has metals toxicity been observed.” Similarly, when SEM minus AVS is above zero, the portion of the metals in excess of the AVS concentration can potentially exist as free metals, and thus can potentially be bioavailable and toxic. Conversely, when the SEM:AVS ratio is greater than 1 (or the SEM minus AVS is below zero), toxicity is often, but not always, predicted. This suggests that other binding phases beyond AVS (e.g., TOC) may also limit the bioavailability and resulting toxicity of metals in sediments.

USEPA (2005) guidance on metals bioavailability evaluates possible binding of metals by both AVS and organic matter. Sediment data were evaluated on a sample-by-sample basis using the following scale (USEPA, 2005), in addition to the SEM:AVS ratios and the SEM minus AVS concentration, to evaluate whether the organic carbon binding phase (represented as fraction organic carbon or $f_{oc}$), in conjunction with the AVS, is affecting the bioavailability of divalent metals in sediments:

- If the $(\sum SEM-AVS)/f_{oc}$ excess exceeded 3,000 µmol/$g_{oc}$, the sediments were presumed "likely to be toxic"
- If the $(\sum SEM-AVS)/f_{oc}$ excess was between 130 and 3,000 µmol/$g_{oc}$, predictions of effects were uncertain
- If the $(\sum SEM-AVS)/f_{oc}$ excess was less than 130 µmol/$g_{oc}$, the sediments were presumed "not likely" to be toxic

A summary of the SEM, AVS, and TOC data is presented in **Table 4-3** and **Figure 4-1**. At two locations, SED7B and SED8B, AVS was not detected. The SEM:AVS ratios for the remaining Waterside Investigation Area samples and background samples for which AVS was detected suggest that the divalent metals may be bioavailable because sulfides may not be sufficient to limit the bioavailability of the divalent metals. However, the ratio of total SEM concentration to AVS, normalized to the organic carbon content (referred to as $(\sum SEM/AVS)/f_{oc}$), does not exceed the benchmark of 130 µmol/$g_{oc}$ in all Waterside Investigation Area and background samples. This suggests that when the binding capability of the TOC is also considered, no samples within the Waterside Investigation Area and no background samples are predicted to have bioavailable divalent metals. Based on these results, exposure to divalent metals in surficial sediments in the Waterside Investigation Area is not expected to pose a risk to benthic receptors.

In 2013, the $(\sum SEM/AVS)/f_{oc}$ results for sediments collected from four Site locations near the Cove (SED7B, SED7E, SED7G, and SED8C) exceeded 130 µmol/$g_{oc}$ (but were below 3,000 µmol/$g_{oc}$), indicating that prediction of adverse biological effects to ecological organisms due to exposure to divalent metals at these locations is uncertain (**Figure 4-1**). However, at two locations (SED7B and SED8C), the $(\sum SEM/AVS)/f_{oc}$ results for field duplicates were less than 130 µmol/$g_{oc}$. None of the 2013 samples contained $(\sum SEM/AVS)/f_{oc}$ at concentrations in excess of 3,000 µmol/$g_{oc}$. Therefore, the 2017 evaluation of SEM, AVS, and TOC results are similar to, and slightly improved from, the findings of the Preliminary BERA.

### 4.2.2 Laboratory Toxicity Testing

Laboratory toxicity tests were used to evaluate the bioavailability of COPCs to potential biological receptors and determine if sediments collected adjacent to the Waterside Investigation Area pose potential risk through an estimate of direct toxicity. A 10-day amphipod (*Hyalella azteca*) test based on USEPA Test Method 100.1 (USEPA, 2000) and a 10-day midge (*Chironomus dilutus)* test based on USEPA Test Method 100.2 (USEPA, 2000) were conducted. For both tests, survival, growth (average weight based on the number of surviving organisms), and biomass (average weight based on the number of organisms at test initiation) were the measured endpoints.

All toxicity tests were conducted under specified laboratory conditions using whole environmental media. All testing was conducted by Aquatec Environmental, Inc., in Williston, Vermont; associated reports are provided in **Attachment E**.

Sediment for the toxicity tests was collected from 15 locations in the Waterside Investigation Area and five upstream background locations (**Figure 2-1 and Figure 2-2**). Testing of samples representative of upstream background conditions (i.e., reference conditions that included localized pollutants) provided a “site-specific basis for evaluating toxicity of the test sediments” (USEPA 2000). Sediment samples collected for laboratory toxicity testing were co-located in time and space with sediment chemistry, pore water, and macroinvertebrate community sampling locations to permit a detailed evaluation of the coinciding data.

Standardized statistical tests were conducted to determine if there were significant differences in test endpoints. The statistical tests evaluated the potential differences between Waterside Investigation Area, background, and laboratory control samples. **Table 4-4** provides the results of the statistical comparisons for the 10-day amphipod test, and **Table 4-5** provides the results of the statistical comparisons of the 10-day midge test.

#### 4.2.2.1 Comparisons to Test Acceptability Criteria

Comparing test acceptability criteria to the test results provides context. Test acceptability criteria were identified in freshwater sediment toxicity testing guidance (USEPA, 2000). The test acceptability criterion for the amphipod (*Hyalella azteca*) assay was 80% survival at test termination for control sediment. The laboratory control (as well as the background and Waterside Investigation Area samples) achieved at least 80% survival in the *Hyalella azteca* tests.

Two test acceptability criteria were available for the midge (*Chironomus dilutus)* tests: at least 70% survival on day 10 for control sediment and an ash free dry weight of greater than 0.48 milligram (mg)/surviving individual on day 10 (USEPA 2000). Average survival in the laboratory control samples (as well as the background and the Waterside Investigation Area samples) achieved at least 70% survival on day 10 and met the weight-based test acceptability criteria.

#### 4.2.2.2 Statistical Evaluation

The results of the laboratory toxicity tests conducted on Waterside Investigation Area samples were compared to the results of both laboratory control tests and tests conducted with the five background samples. Standardized statistical tests (e.g., paired t-test comparisons) were conducted to determine if there were significant differences in survival, growth, or biomass.

**Tables 4-4** and **4-5** identify the samples that are statistically different from the laboratory control or the five background samples for the amphipod (*Hyalella azteca)* and midge (*Chironomus dilutus)* assays, respectively. **Figures 4-2** and **4-3** summarize the results for the amphipod (*Hyalella azteca)* and midge (*Chironomus dilutus)* assays, respectively. The findings of statistical differences are presented in the matrices below for each organism.

**Statistical Differences (p<0.05) in Survival and Growth for Amphipod (*Hyalella azteca*)**

| | SEDBACK16 | SEDBACK17 | SEDBACK18 | SEDBACK19 | SEDBACK20 | SED6.5D | SED6.5E | SED7.5D | SED7.5E | SED7D | SED7E | SED7F | SED6A | SED6B | SED6C | SED7A | SED7B | SED8A | SED8B | SED8C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SURVIVAL** | | | | | | | | | | | | | | | | | | | | |
| Lab Control | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK16 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK17 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK18 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| SEDBACK19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| SEDBACK20 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **GROWTH** | | | | | | | | | | | | | | | | | | | | |
| Lab Control | X | -- | -- | -- | -- | -- | -- | X | X | -- | X | X | X | -- | X | -- | X | X | -- | X |
| SEDBACK16 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK17 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| SEDBACK18 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| SEDBACK19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK20 | -- | -- | -- | -- | -- | -- | -- | X | X | -- | X | -- | X | -- | -- | -- | X | X | -- | X |

X – Statistically significant difference (p<0.05)
No difference indicated by a dash.

**Statistical Differences (p<0.05) in Survival and Growth for Midge (*Chironomus dilutus*)**

| | SEDBACK16 | SEDBACK17 | SEDBACK18 | SEDBACK19 | SEDBACK20 | SED6.5D | SED6.5E | SED7.5D | SED7.5E | SED7D | SED7E | SED7F | SED6A | SED6B | SED6C | SED7A | SED7B | SED8A | SED8B | SED8C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SURVIVAL** | | | | | | | | | | | | | | | | | | | | |
| Lab Control | X | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK16 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK17 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK18 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SEDBACK20 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **GROWTH** | | | | | | | | | | | | | | | | | | | | |
| Lab Control | X | -- | -- | -- | -- | -- | -- | X | X | -- | X | X | X | -- | X | -- | X | X | -- | X |
| SEDBACK16 | -- | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| SEDBACK17 | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| SEDBACK18 | -- | -- | -- | -- | -- | X | -- | X | X | -- | X | -- | -- | -- | X | -- | X | -- | -- | X |
| SEDBACK19 | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| SEDBACK20 | X | X | X | X | -- | X | X | X | X | X | X | X | -- | X | X | X | X | -- | X | X |

X – Statistically significant difference (p<0.05)
No difference indicated by a dash.

Based on the above results of the amphipod and midge toxicity tests, the responses of the background location SEDBACK16 are statistically different from the laboratory control and many of the Waterside Investigation Area sample responses. Because similar results were not observed for the other upstream background samples, other factors such as grain size and TOC may explain these differences in toxicity test responses of SEDBACK16.

Overall, amphipod and midge survival responses were similar among background and Waterside Investigation Area samples as illustrated in **Figures 4-2** and **4-3.** In addition, survival and growth was similar among Waterside Investigation Area samples located in the Cove and Waterside Investigation Area samples located in the channel. Only one location (SED7B, located in the channel) had reduced amphipod survival relative to two background samples. There were no differences among Waterside Investigation Area and background samples for midge survival. Greater differences were observed for the growth endpoints than survival. Although significant differences were observed between responses of several Study Area samples and one to two background samples for the amphipod and midge growth endpoints, the responses for two Study Area samples (SED7B and SED7.5E) were significantly different from most background samples. For the amphipod test, reduced growth was observed in Site sample SED7B relative to three background samples. For the midge test, two site samples, SED7B and SED7.5E (collected in the Cove), had reduced growth responses relative to all background sample responses.

The amphipod and midge tests are based on a 10-day test duration, which limits the interpretation of potential longer-term chronic impacts. However, these sediment bioassays are one of several lines of evidence included in this BERA to evaluate potential impacts to the benthic invertebrate community. In addition, chronic impacts to the benthic community are also evaluated in the benthic community survey (Section 4.2.3) in which chronic exposures are expected to result in degraded benthic communities. Longer duration amphipod tests were included in the ARSP RI, and the results of these tests for sampling locations in the Waterside Investigation Area are discussed in the following section. The uncertainties related to test duration are further discussed in the Uncertainty Evaluation (Section 6.1.5).

#### 4.2.2.3 Summary of ARSP Toxicity Testing Within the Waterside Investigation Area

As part of the ARSP RI, sediment toxicity testing was conducted on 82 surface sediment samples from within the ARSP study area. Testing included 10-day testing with the midge (*Chironomus dilutus)* and 42-day testing with the amphipod (*Hyalella azteca*). Test endpoints for the midge assay included survival, growth, and biomass, consistent with the testing described in Section 4.2.2. The 42 day amphipod assay included survival measurements on Day 28, Day 35, and Day 42, growth and biomass endpoints on Day 28 and Day 42, and reproduction measured on Day 42.

Six of the locations considered as part of the ARSP RI were located within the Waterside Investigation Area. From upstream to downstream these locations include: R6-23, R6-22, R6-21, R6-18, R5-06, and R5-04 (**Figure 2-2**). **Table 4-6** and **Table 4-7** summarize the results of the midge and amphipod testing, respectively, for these six locations. Test results that are statistically lower than the associated laboratory controls are shown on the tables. The results of the five Potomac River sediment toxicity test samples, which were collected as background samples for the ARSP, were not considered because they were tested in one batch rather than in multiple batches with Site samples and had anomalously high growth and reproduction relative to the laboratory controls.

As indicated in **Table 4-6**, the test acceptability criteria for the midge assay (70% survival and ash free dry weight of greater than 0.48 mg/surviving organism) were met by all laboratory controls and Site samples with one exception. Mean survival for location R5-04 was 66.3%, slightly below the 70% criterion. The two most downstream samples showed the least impacts to the midge relative to the laboratory controls. Location R5-06 showed no toxicity and location R5-04 showed survival but not growth or biomass impacts. Growth and biomass, but not survival, for locations R6-23 and R6-22 were statistically lower than in the laboratory controls and all three endpoints were statistically lower than the laboratory controls for locations R6-21 and R6-18.

As indicated in **Table 4-7**, the test acceptability criterion for the amphipod assay (at least 80% survival on Day 28; USEPA, 2000) was met by all laboratory controls and Site samples with one exception. Survival (n=8) from location R6-23 was 78.8%, which is slightly below the criterion. Similar to the midge results, the two most downstream samples showed the least impact with no statistical differences from the laboratory control for survival, growth, or reproduction for locations R5-06 or R5-04. Survival was impacted, relative to the laboratory control for one location (R6-23) on Day 42, but not on Day 28 or 35. Biomass, but not growth, was impacted, relative to the laboratory controls for location R6-22 on Day 28 and locations R6-23, R6-21, and R6-18 on Day 42. Reproduction was impacted relative to the laboratory controls for the two most upstream locations (R6-23 and R6-22).

In general, the midge test responses summarized in **Table 4-5** (Pepco sediment bioassays) and **Table 4-6** (ARSP sediment bioassays) are similar with fewer stations impacted for survival than for growth relative to the laboratory control and most samples meeting test acceptability criteria. The amphipod results summarized in **Table 4-4** (Pepco sediment bioassay) and **Table 4-7** (ARSP sediment bioassay) are not comparable due to the differences in durations and endpoints; although most samples met their respective test acceptability criteria. Growth and biomass were more sensitive endpoints than survival in both sets of amphipod tests. However, the longer duration reproduction endpoint was not more sensitive than biomass in identifying impacted locations in the ARSP tests.

There is no significant overlap between the ARSP sample locations and the Waterside Investigation Area samples collected in 2017. ARSP location R6-21 occurs in the same general area as the Cove locations, but the remaining ARSP samples are upstream or downstream from the Cove. Location R6-21 was impacted for all three endpoints in the midge assay and for amphipod biomass at Day 42. The Cove locations showed some impacts relative to the lab control for both the 10-day midge and amphipod assays. The 10-day growth results for the Cove samples showed impacts in multiple samples, while the R6-21 test only showed biomass, but not growth, impacts and only at 42 days, not at the shorter durations (28 and 35 day).

The ARSP RI (Tetra Tech, 2018) evaluated the contribution of chemical and physical stressors to the toxicity results in the laboratory bioassays using regression/correlation analysis. Potential stressors considered in the evaluation included PAH potency ratios, $\sum$SEM-AVS/$f_{oc}$, total chlordane concentrations, total PCBs as Aroclors, dioxin TEQ, dioxin-like PCB TEQ, TPAH (sum of the parent and alkylated PAH compounds), maximum ammonia concentration, during testing, TOC, percent silt and clay, and percent clay. The analysis did not identify a single chemical or physical stressor or combination of stressors that explained the test results throughout the study area or subdivision of the study area. As reported in the ARSP RI (Tetra Tech, 2018), these results are consistent with previous reports of poor correlation between sediment quality benchmarks, benthic community health, and chemical concentrations in the tidal Anacostia River (McGee et al. 2009) and it is possible that chemicals other than the priority pollutants measured in the RI, or other factors, may have contributed to the toxicity results.

### 4.2.3 Benthic Macroinvertebrate Community Survey

A benthic macroinvertebrate community survey was conducted on sediment collected from 15 locations in the Waterside Investigation Area and five upstream background locations (**Figures 2-1** and **2-3**). Sediment samples collected for the macroinvertebrate community survey were co-located in time and space with sediment chemistry, toxicity testing, and pore water sampling locations to permit a detailed evaluation of the coinciding data.

The benthic macroinvertebrate sample collection and processing and data analyses were conducted by Normandeau Associates, Inc. Biologists certified for taxonomic analysis by the Society for Freshwater Science identified the specimens. The report is presented in **Attachment F**.

The laboratory analyses were conducted according to two agency protocols that are applicable to the project: the *Maryland Biological Stream Survey Sampling Manual* (MDNR, 2014) and the *Rapid Bioassessment Protocol for Use in Wadeable Streams and Rivers* (Barbour et al., 1999). The samples were sieved through a 0.500-micron mesh sieve and sorted to randomly remove a targeted final count of 80 to 120 specimens.

Four replicate samples were collected at each sampling location. Taxonomic analyses were conducted on three of the four replicates per location. Several measures were taken to ensure quality control of the samples. To comply with the Maryland Department of Natural Resources protocol requirements for quality control, the fourth replicate was analyzed from three locations to compare the density of organisms to the range of densities measured in the first three replicates. The number of specimens was similar among the four replicates per location. In addition, laboratory duplicates (i.e., an additional 100 organisms that were removed from each sample) were also analyzed for similarity using the Morisita's Index of Community Similarity statistic, and the results suggested a high degree of similarity. Finally, a second biologist verified that the efficiency of specimen removal and the identification and enumeration of taxonomy was over 90%, which is considered acceptable for quality control.

The benthic macroinvertebrate community consists of organisms expected to be present in soft bottom freshwater tidal habitats and include aquatic worms (Oligochaeta), midges (Chironomidae), Asiatic clams (*Corbicula fluminea*), round worms (Nematoda), pill clams (*Pisidium*), leeches (Glossiphoniidae), and crustaceans (*Caecidotea* and *Gammarus*). A total of 35 taxa were collected indicating taxonomically poor benthic macroinvertebrate communities at Waterside Investigation Area and background sampling locations. The fewest taxa were identified at background location SEDBACK19 and the greatest number of taxa was present at Waterside Investigation Area locations SED6A and SED7A. Worms (*Limnodrilus* spp.), Asiatic clams, Nematoda, and the chironomids *Tanypus neopunctipennis* and *Chironomus decorus* were the most abundant organisms.

Spearman's Rank Correlation Coefficients, which were calculated to compare the numbers of taxa collected at Waterside Investigation Area and background sample locations, indicated similarity among Waterside Investigation Area and background locations. A dendrogram (**Figure 4-4**) groups the sampling locations according to similarity and illustrates three general groupings: Waterside Investigation Area sampling locations in the channel (SED6A, 6B, 7A, 7B, 8A, and 8B), background and Waterside Investigation Area sampling locations in the channel (SEDBACK16, 17, 18, 19, and 20, SED6C and SED8C), and Waterside Investigation Area sampling locations in the Cove (SED6.5D, 6.5E, 7D, 7E, 7F, 7.5D, and 7.5E). These groupings are expected based on the grain size differences observed in the channel versus the Cove.

The Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI) was used to evaluate the macroinvertebrate data according to ecological metrics such as abundance per area, abundance of pollution-indicative taxa, abundance of deep-deposit feeders, tolerance score, taxa richness, and percent contribution of dominant taxa. The results of these metrics for Waterside Investigation Area and background samples were compared using two-sample hypothesis tests and are presented in **Figure 4-4**. No statistical differences were found between Waterside Investigation Area and background samples for mean number of taxa and mean tolerance scores. Density was significantly higher in Waterside Investigation Area samples compared to background and significantly higher numbers of pollution-tolerant taxa and deep-deposit feeders were found in background samples in comparison to Waterside Investigation Area samples.

The Chesapeake Bay B-IBI scores were calculated based on the results of four ecological metrics: overall abundance, abundance of pollution-indicative taxa, abundance of deep-deposit feeders, and tolerance score. The B-IBI scoring criteria are presented in Table 2 of **Attachment F**. The total B-IBI score per location is presented in **Table 4-8**. A score greater than 3 "meets the restoration goals" of the Chesapeake Bay Benthic Monitoring Program, whereas a score of 2 or lower is considered "severely degraded." The average Waterside Investigation Area B-IBI score (2.77) is greater than the average background score (2.03). Six Waterside Investigation Area locations (two in the channel and four in the Cove) have B-IBI scores of 3 or greater. The background locations had scores rated between degraded to severely degraded. Only one Waterside Investigation Area location (SED8C) scored as "severely degraded."

### 4.2.4 Pore Water Benchmark Screening

Pore water COPCs were identified by comparing maximum detected chemical concentrations measured in pore water collected at the 15 near-Site sediment sample locations (**Figure 2-1**) to applicable chronic surface water ESVs (**Table 4-9**), which were selected from the following hierarchy of resources:

- DOEE Water Quality Standards (WQS) for the protection of freshwater aquatic life (DOEE, 2014)
- USEPA Region 3 Freshwater Screening Benchmarks (USEPA, 2006)
- Literature-based toxicological benchmarks (Suter and Tsao, 1996; Buchman, 2008)

USEPA conversion factors were used to calculate both total and dissolved ESVs for several hardness-dependent constituents (i.e., cadmium, chromium, copper, lead, nickel, and zinc).

Chemicals were identified as COPCs if the maximum pore water concentration was greater than the chronic ESV or because an ESV was not available for a particular COPC. The results of the COPC identification process are presented in **Table 4-10**. Pore water COPCs include:

- Three dissolved phase metals: barium, iron, and manganese
- One total recoverable phase metal: iron
- One SVOC: pyrene

Notably, PCB concentrations were below the chronic criteria in all 15 sampling stations evaluated.

Pore water is evaluated on a sample-by-sample basis in Section 5.1.2. The bioavailable fraction of PAHs in pore water is evaluated further in Section 4.2.5.

### 4.2.5 Bioavailable Fraction of PAHs in Sediment and Pore Water

All of the 2017 bulk sediment and pore water samples were analyzed for 34 parent and alkylated PAHs (PAH-34), which is consistent with USEPA's (2003) Equilibrium Partitioning Sediment Benchmark (ESB) guidance for PAH mixtures and USEPA's 2009 white paper *Evaluating Ecological Risk to Invertebrate Receptors from PAHs in Sediments at Hazardous Waste Study Areas* (Burgess, 2009). For hydrophobic organic constituents like PAHs, under equilibrium conditions, the interstitial water (i.e., pore water) concentration of PAH is the most accurate indicator of the bioavailable exposure concentration. The 2009 USEPA publication provides a conceptual model for applying various sediment approaches in a tiered system to determine potential risks from exposure to PAH mixtures in sediment. The PAH-34 and TOC data were used to evaluate the potential for bioavailable PAHs in sediment and pore water to cause direct toxicity to benthic invertebrates.

Pore water represents the bioavailable fraction of COPCs in sediments, and the evaluation described in USEPA (2003) guidance estimates the bioavailable PAHs present in sediment. The theory of EqP has been the basis for the study of toxicity of sediment for decades and has been the basis for sediment guidelines since the early 1990s (USEPA, 1993). EqP theory states that certain chemicals, such as PAHs, may be present in sediment, but may be partitioned to binding factors, such as organic carbon. As the science has developed, additional binding factor indicators have been identified. These other binding factors, such as black carbon, are often found in urban environments such as the Anacostia River, and may produce site-specific partitioning factors much higher than levels commonly used in EqP theory.

PAHs are generally considered to be Type I narcotic chemicals (i.e., those chemicals exhibiting narcosis as a mode of action); narcosis is a non-specific mode of action whereby the organisms exhibit a state of arrested activity (USEPA, 2003). The narcosis theory relies on the additivity of the toxicity of the group of chemicals. The bioavailable concentration of each PAH compound from each sample, either measured in pore water or predicted in sediment using EqP, is converted to a TU by dividing the concentration of each PAH compound by the chemical-specific effects endpoint. In sediment, the sum of the ESB TUs ($\sum$ESBTU) is then used to predict toxicity. The endpoints are the FCVs presented in USEPA (2003) expressed as micrograms per gram organic carbon (μg/$g_{oc}$), which is derived as the product of the PAH-specific FCV and the respective $K_{oc}$ value.[4]

**Table 4-11** presents the calculation of the ∑ESBTU for the 2017 Waterside Investigation Area and background surface sediment samples. Individual PAH sediment concentrations ($C_s$) were divided by $f_{oc}$ (referred to as the $C_{OC,\ PAHi}$) to normalize the PAH concentration to the sample-specific organic carbon content. Dividing ($C_{OC,\ PAHi}$) by the FCV (referred to as the $C_{OC,\ PAHi,\ FCVi}$) generates a PAH-specific TU. If ∑ESBTU is <1.0, the concentration of the PAH mixture is acceptable for the protection of benthic invertebrates (USEPA, 2003):

$$ESB = \sum ESBTU_{FCV} = \sum_{i=1}^{34} \frac{C_{oc,PAHi}}{C_{oc,PAHi,FCVi}} \leq 1.0$$

All ∑ESBTUs were less than 1 in all Waterside Investigation Area and background samples with the exception of two Waterside Investigation Area samples: SED7B (located in the channel) and SED7.5D (located in the Cove).

Similar to sediment, the individual PAH results for the 2017 Waterside Investigation Area and background pore water samples were evaluated against the USEPA (2003) FCVs and summed to generate a pore water TU, referred to as the ∑EqPTU (**Table 4-12**). If ∑EqPTU is <1.0, the concentration of the PAH mixture is acceptable for the protection of benthic invertebrates (USEPA, 2003):

$$\Sigma EqPTU_{FCV,24} = \left( \sum_{i=1}^{24} (C_{pw}) / FCV \right)$$

As indicated in **Table 4-12**, the ∑EqPTU values were less than 1 in all Waterside Investigation Area and background samples with the exception of SED7B. **Figure 4-5** also presents the ∑ESBTU and ∑EqPTU values for Waterside Investigation Area and background samples.

The above results indicate that, at most locations, the results for sediment and pore water TUs generally correspond with one another, and do not indicate the potential for toxicity to benthic organisms as a result of PAHs in sediment. Although the sediment ∑ESBTUs indicated the potential for PAH bioavailability in sediment at SED7.5D, this result was not supported by the direct measure of PAH toxicity in pore water at

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[4] $K_{oc}$ is the chemical-specific organic carbon-water partition coefficient.

this location. At SED7B, the results of both sediment and pore water suggest the potential for toxicity related to PAHs. These results are further evaluated in Section 5.1.

## 4.3 Fish Community Risk Analysis

Potential risks to fish from COPC exposure via ingestion of sediment and contaminated food items was evaluated through an assessment of fish tissue body burdens. Tissue concentrations of potentially bioaccumulative constituents measured in fish tissue samples collected in the vicinity of the Waterside Investigation Area were evaluated relative to literature-derived CBRs. CBRs were presumed to represent threshold tissue concentrations when concentrations in excess of the CBR value could potentially result in adverse biological effects on the exposed fish (not consumers of fish). This section presents the COPCs identified for this pathway, the tissue data used to evaluate exposure, and the derivation of effects concentrations (CBRs).

### 4.3.1 COPC Identification for the Fish Tissue Evaluation

The list of COPCs for the fish tissue evaluation was identified from the list of constituents detected in sediment (**Table 4-2**) and that are potentially bioaccumulative in fish tissue.[5] The list of COPCs includes 10 inorganic COPCs (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc), eight pesticides compounds (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, chlordane, dieldrin, endrin, and heptachlor epoxide), total PAHs, total PCB congeners, and TCDD-TEQ (calculated for fish).

### 4.3.2 Estimates of Exposure

The fish tissue data set collected by Tetra Tech on behalf of the DOEE to support the ARSP (Tetra Tech, 2018) was used in this fish tissue evaluation (samples are presented in **Table 2-3**; analytical data are presented in **Attachment A**). The samples identified for the fish tissue evaluation were collected from within Exposure Unit 3, which encompasses an area ranging from approximately 1.4 miles upstream of the Waterside Investigation Area just past the Kenilworth Park Landfill and approximately 1.4 miles downstream to the CSX bridge (2.8 miles total), and Kingman Lake. Composite samples of forage fish, mid-trophic level fish, and upper trophic level fish were used to represent the fish in the Waterside Investigation Area.

[5] As presented in Table 4-2 of *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment Status and Needs* (USEPA, 2000).

### 4.3.3 Identification of Fish Tissue CBRs

To evaluate the potential impact to the fish community due to exposure to COPCs in the Anacostia River within the Waterside Investigation Area, ranges of no-effect and low-effect CBRs for total PCBs were compiled from the literature. These ranges represent tissue concentrations resulting from actual exposures that could result in adverse biological effects. Values were derived based on no observed effect concentrations (NOECs) and lowest observed effects concentrations (LOECs). NOECs indicate a body residue concentration at which no adverse effects were observed and LOECs indicate a body residue concentration at which adverse effects may begin to be observed.

The Jarvinen and Ankley database (1999) and U.S. Army Corps of Engineers (USACE) Environmental Residue Effects Database (http://el.erdc.usace.army.mil/ered/) were the primary sources of CBRs considered. A single NOEC CBR was selected for each of two fish life stages: 1) early life stage (sensitive), and 2) adult (less sensitive). Studies were considered valid for the purposes of this evaluation if they met the following requirements:

- Based on whole body tissue residues
- Based on freshwater fish species (saltwater species were not included)
- Based on reproduction, growth, and survival/mortality effects

Any no-effect CBR values with no associated effects values from the same study were not included (i.e., no-effect values must be bounded by an effect value for the same endpoint from the same study). In addition, only NOECs or LOECs were considered; alternative effects levels, such as LC50 (lethal concentrations resulting in 50% mortality), were considered if no acceptable no-effect or lowest-effect values were available. The results of the CBR search are presented in **Attachment G**. The range of NOEC and LOEC CBRs compiled from the literature provide context for the variation between species and endpoints, and are presented in **Table 4-13**.

### 4.3.4 Comparison of Fish Tissue Concentrations to CBRs

The ranges of detected COPC concentrations in fish tissue are compared to the range of NOEC and LOEC CBRs in **Table 4-13**. Maximum and/or average fish tissue concentrations were less than the maximum NOEC and LOEC CBRs for all COPCs. No CBRs are available for chlordane and heptachlor epoxide. This evaluation indicates that there is little to no potential for risk to the fish community from exposure to bioaccumulative COPCs in their tissue.

## 4.4 Wildlife Community Risk Analysis

Potential exposure routes for wildlife receptors include potential direct or indirect ingestion of surface water, sediment, and ingestion of food items containing COPCs. To evaluate potential wildlife exposure, representative wildlife species were selected for evaluation in a food chain model that estimates exposures to wildlife species respective to their position in the food chain. The following subsections present representative species, exposure parameters, COPC concentrations in prey items, calculation of potential doses, and evaluation of effects for vertebrate wildlife receptors.

As detailed for the Fish Tissue Evaluation (Section 4.3.1), PCBs are expected to be the most relevant Site-related bioaccumulative compound within the exposure area and were the sole COPC included in the wildlife evaluation in the Preliminary BERA. However, this BERA includes a broader array of inorganic and organic COPCs in the wildlife risk analysis, and includes fish and benthic invertebrate tissue residue data collected as part of the ongoing ARSP RI. These tissue residue data were collected to evaluate broader Anacostia River RI concerns, and although the reach of the river from which they were collected includes the Waterside Investigation Area, there is no indication that the tissue data are representative of Waterside Investigation Area conditions. The list of COPCs for this evaluation was identified from the list of constituents detected in sediment (**Table 4-2**) and in fish and/or invertebrate tissue that are potentially bioaccumulative.[6] The list of COPCs includes 10 inorganic COPCs (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc), 14 pesticide compounds (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, alpha-hexachlorocyclohexane (BHC), beta-BHC, chlordane, delta-BHC, dieldrin, endosulfan I, endrin, gamma-BHC [lindane], heptachlor, and heptachlor epoxide), total LMW PAHs, total HMW PAHs, total PCB congeners, and TCDD-TEQs for birds and mammals.

The Preliminary BERA indicated that concentrations of bioaccumulative COPCs in surface water are low. Water ingested as drinking water is not expected to contribute significantly to wildlife risks, particularly relative to the ingestion of sediment and prey items; therefore, water ingestion was not evaluated in the food chain model.

### 4.4.1 Representative Species

As described in Section 3.1.2, the Waterside Investigation Area includes riverine aquatic habitat and wetland habitat. These areas may offer habitat resources for a variety of vertebrate wildlife species. Due to the steep elevation change between the upland and the river, there is a general lack of wading habitat along most of the shoreline adjacent to the Waterside Investigation Area (i.e., the river becomes deep

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[6] As presented in Table 4-2 of *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment Status and Needs* (USEPA, 2000).

very quickly). However, it was assumed that birds and mammals could be exposed to sediments and prey items (i.e., fish) from within the Waterside Investigation Area.

Since constituents may biomagnify through the food chain, representative vertebrate wildlife species from upper trophic levels were selected for evaluation. Carnivores and piscivores represent the top of the food chain and are potentially exposed to the higher levels of bioaccumulated analytes. Therefore, three primarily piscivorous wildlife receptors were evaluated in the food chain model: great blue heron, belted kingfisher, and raccoon. The following is a brief description of the modeled species.

- **Great Blue Heron (*Ardea herodias*)** – The great blue heron was selected as a representative avian piscivore for evaluation of potential risks associated with exposure through the ingestion of fish. The great blue heron occupies a variety of freshwater and marine areas, including brackish marshes, coastal wetlands, lakes, and rivers where small fish are abundant in shallow areas. Fish are preferred prey, but they also feed on amphibians, reptiles, insects, crustaceans, birds, and mammals (USEPA, 1993). The great blue heron is a wading bird and not likely to be found in deep water.
- **Belted Kingfisher *(Megaceryle alcyon)*** – The belted kingfisher was selected as an additional piscivorous avian receptor for the evaluation of potential risks associated with exposure through ingestion of fish. The belted kingfisher inhabits shorelines of rivers, streams, and estuaries and feed on fish swimming near the surface or in shallow waters. In addition to fish, belted kingfishers consume crayfish, crabs, mussels, small amphibians and reptiles such as frogs and lizards, young birds and mice, and berries (USEPA, 1993). The belted kingfisher feeds by diving head first into the water, and water depths of 60 cm or less are preferred (USEPA, 1993).
- **Raccoon (*Procyon lotor*)** – The raccoon was selected as a representative small omnivorous mammalian wildlife species that may be found within aquatic exposure areas. The raccoon is the most abundant and widespread medium-sized omnivore in North America. Raccoons are commonly found in aquatic habitats, particularly in hardwood swamps, floodplain forests, and freshwater and saltwater marshes. They are also common in suburban residential areas. Raccoons are omnivorous and feed primarily on insects, small mammals, birds, lizards, and fruits (USEPA, 1993). The raccoon is expected to forage on the nearshore and banks of the Waterside Investigation Area and is unlikely to forage in deep waters. It is assumed that the raccoon consumes primarily fish and invertebrates from the shoreline areas.

### 4.4.2 Estimates of Exposure

Wildlife species may potentially be exposed to COPCs in sediment and prey (fish and/or invertebrate) tissue through the incidental ingestion and food chain exposure pathways. Exposure due to ingestion of water is expected to be minimal, and this pathway is not quantified in the food chain model. Exposure assumptions (body weights, food ingestion rates, relative consumption of food items, foraging range, exposure duration, etc.) for the great blue heron, belted kingfisher, and raccoon were obtained from the USEPA's *Wildlife Exposure Factors Handbook* (USEPA, 1993) and are provided in **Table 4-14**. Allometric equations developed for birds and mammals (Nagy, 2001) were used to estimate food ingestion rates. Calculation of the ingested doses is discussed below.

Wildlife exposure parameters and concentrations of COPCs in sediment, benthic invertebrate tissue, and fish tissue were used to estimate the potential ingested doses to which wildlife receptors might be exposed at the Waterside Investigation Area. Maximum EPCs for sediment, benthic invertebrate tissue, and fish tissue were used in the food chain model. The sediment data set represents samples collected from locations within the Waterside Investigation Area, including all Pepco and ARSP data (**Table 2-1**). The benthic invertebrate and fish tissue data sets (**Tables 2-4** and **2-3**, respectively) were collected by Tetra Tech on behalf of the DOEE to support the Anacostia River Sediment Project. Samples used in the food chain model were collected from within Exposure Unit 3 and Kingman Lake (described in Section 2.5). Forage fish and mid-trophic level fish samples were used to represent fish in the food chain model, and the benthic invertebrate tissue data set included snails, clams, and crayfish (Tetra Tech, 2018).

The food chain model included the following species- and chemical-specific assumptions regarding exposure factors:

- Representative species body weight and food intake are the average for the range identified in the literature.
- COPCs in sediment, benthic invertebrate tissue, and fish tissue are 100% bioavailable to representative species.
- Raccoons and belted kingfishers are present year-round.
- Herons are present for 8 months of the year, and some herons may overwinter in the Anacostia River; therefore, it was assumed that herons are present year-round.
- Representative species obtain all of their daily dietary requirements from within the Waterside Investigation Area (i.e., they only consume food found within the Waterside Investigation Area).

#### 4.4.2.1 Calculation of Potential Doses

To estimate potential dietary exposure, a total daily dose (TDD) was estimated for each species. The TDD calculation considers the following factors: concentrations of COPCs in the food items that the species would consume, estimated amounts of abiotic media (e.g., sediment) that it would incidentally ingest, the relative amount of different food items in its diet, body weight, exposure duration (ED), species-specific area use factors (AUFs), and food ingestion rates. The ED represents the portion of the year that the receptor is exposed to the site (which may be modified by migration). An AUF is defined as the ratio of the exposure area to the size of organisms' home range, and for the purposes of this evaluation, was assumed to be equal to one (i.e., all three representative species could use the entire exposure area).

The following generalized equation was used to evaluate the TDD from all sources (i.e., prey items and incidental ingestion) for each COPC:

$$TDD = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s]) \times ED \times AUF}{\text{Body Weight}}$$

where:

- $IR_f$ = Ingestion rate of food (kilograms wet weight [$kg_{ww}$]/day)
- $IR_s$ = Incidental ingestion rate of sediment (kilograms dry weight [$kg_{dw}$]/day)
- $C_f$ = Concentration of COPC in prey (milligrams wet weight [$mg_{ww}$]/kg)
- $C_s$= Concentration of COPC in sediment (milligrams dry weight [$mg_{dw}$]/kg)
- ED = Exposure duration (fraction of time receptor spends within exposure area)
- AUF = Area use factor (ratio of the exposure area to the receptor's home range)

The sum of the doses from the various sources represents the full TDD from each COPC that a receptor may be exposed to as a result of foraging within the Waterside Investigation Area. This generalized equation was modified for each representative species using the exposure parameters presented in **Table 4-14**.

### 4.4.3 Estimation of Effects

For the purpose of evaluating potential risks to wildlife, TRVs were identified for both avian and mammalian receptors. The TRV relates the dose of a respective COPC from oral exposure with a potential adverse effect. TRVs can be defined as the daily dose of a constituent that is considered protective of wildlife (mammals and birds) populations or individuals. The dose is expressed in milligram per kilogram body weight per day (mg/kg$_{bw}$/day) and can be based on either a No Observed Adverse Effects Level (NOAEL) or a Lowest Observed Adverse Effects Level (LOAEL).

USEPA guidance (USEPA, 1997) specifies that it is preferred that TRVs represent a NOAEL for chronic exposure to Site-related constituents. Should a NOAEL not be available, USEPA guidance allows the use of the lowest exposure level shown to produce adverse effects (i.e., the LOAEL) in the development of TRVs. NOAEL-based TRVs were preferably based on chronic NOAELs, with an emphasis on studies that measured effects on survival, reproduction, and growth endpoints applicable to the protection of wildlife populations.

Both upper- and lower-bound TRVs (LOAEL-based TRVs and NOAEL-based TRVs, respectively) were developed for this assessment in order to estimate a range of potential risks to mammalian and avian receptors. The NOAEL-based TRVs represent non-hazardous exposure levels for the wildlife species evaluated, while the LOAEL-based TRVs represent potential exposure levels at which adverse effects may become evident. For PCBs, a primary COPC, a focused literature evaluation was conducted to define TRVs that best reflect current day ecotoxicological literature. For the majority of other COPCs, broadly accepted compilation sources (e.g., Oak Ridge National Laboratory publications) were the source of TRVs. **Attachment H** describes the derivation of the TRVs used in the food chain model.

### 4.4.4 Wildlife Food Chain Model Results

Potential risks to mammals and birds from exposure to COPCs within the Waterside Investigation Area were assessed using food chain models that estimated a TDD and compared the dose to NOAEL- and LOAEL-based TRVs. **Attachment J** provides the supporting calculations for the food chain model. Hazard Quotients (HQs) (calculated as TDD divided by TRV) for nearly all COPCs for the belted kingfisher, great blue heron, and raccoon were well below or equal to 1 for the maximum exposure scenarios (i.e., considering maximum EPCs and NOAEL- and LOAEL-based TRVs) (**Table 4-15**).

# 5 BERA Risk Characterization

The results of the ecological risk analysis were analyzed and interpreted to determine the likelihood of adverse environmental effects, and to determine whether a conclusion of no significant risk could be reached for each assessment endpoint evaluated. The ecological risk characterization summarizes the results of the risk analysis phase of work and provides interpretation of the ecologically significant findings. Aspects of ecological significance that were considered to help place the Waterside Investigation Area into a broader ecological context included the nature and magnitude of effects of the stressors, the spatial and temporal patterns of effects, results of the nearby background location analyses, and the potential for recovery once a stressor has been removed.

Risk characterization incorporated all available data for the COPCs and pathways. The three assessment endpoints of this BERA are:

- **Assessment Endpoint 1** – Protection and maintenance of freshwater benthic invertebrate populations in aquatic habitats within the Anacostia River Waterside Investigation Area typical of comparable aquatic habitats with similar morphology, hydrology, and urban setting.
- **Assessment Endpoint 2** – Protection and maintenance of fish communities in aquatic habitats within the Anacostia River Waterside Investigation Area typical of comparable upstream aquatic habitats with similar morphology, hydrology, and urban setting.
- **Assessment Endpoint 3** – Protection and maintenance of a piscivorous vertebrate wildlife community in aquatic and wetland habitats within the Anacostia River Waterside Investigation Area typical of comparable aquatic habitats with similar morphology, hydrology, and urban setting.

For each assessment endpoint, the risk characterization includes a risk estimate, determination of ecological significance and risk acceptability, and an evaluation of the uncertainties. The documentation of the risk characterization considers the assumptions, uncertainties (both generic and Site-specific), strengths and weaknesses of the risk analysis, and justification of conclusions regarding the ecological significance of the estimated (i.e., risk of harm) or actual (i.e., evidence of harm) risks. Detected COPC levels in sediments of the Waterside Investigation Area are put into the context of bioavailability, linkage to the Waterside Investigation Area, and potential upstream background sources of contamination that may be impacting the Waterside Investigation Area.

## 5.1 Assessment Endpoint 1: Benthic Macroinvertebrate Community Risk Characterization

Benthic organisms (e.g., those living in sediment) may potentially be exposed to COPCs from direct contact with sediment. The six measurement endpoints identified in Section 3.3 were used to evaluate the benthic macroinvertebrate community in the Waterside Investigation Area. These measurement endpoints are described in the following sections. The complete data set was screened against ESVs to provide a comprehensive spatial and temporal evaluation of potential Site-associated COPCs in surface sediment (Section 5.1.1). A detailed evaluation of potential benthic community effects in BAZ sediment is described in Section 5.1.2, which integrates measurement endpoints within the Sediment Quality Triad framework (COPC distribution and bioavailability, benthic toxicity, and benthic community analysis). Section 5.1.3 describes the benthic invertebrate WOE evaluation.

### 5.1.1 Sediment Benchmark Screening

Sediment benchmark screening was conducted for the Waterside Investigation Area based on the full dataset of 84 surface sediment samples described in Section 2. Surface sediment samples collected by Pepco in Phase I (0 to 15 cm) and Phase II (0 to 10 cm) and by DOEE (0 to 15 cm) were screened against probable effects screening levels and compared to background concentrations, as shown in **Table 5-1**. The background surficial sediment dataset is described in Appendix W of the RI Report and includes 54 samples located upstream of the Waterside Investigation Area that were collected by Pepco and DOEE (summarized in Section 2). Comparisons of Waterside Investigation Area and background surface sediment are based on four lines of evidence including:

- Comparisons of Site concentrations with background threshold values (BTVs)[7].
- Two-sample hypothesis tests (or population tests) that compare the central tendency statistics of the Study Area and background datasets to determine if COPC concentrations measured in Site samples (i.e., the Site population) is different from COPC concentrations measured in background (i.e., the background population).
- Graphical comparisons (boxplots) of Site and background datasets.
- Comparisons of background concentrations with the probable effects screening levels.

As detailed in Appendix W, the BTVs were used to identify Site sample locations at which concentrations of COPCs exceed background whereas the population tests were used to identify COPCs for which the range

[7] The 95% upper tolerance limit of the background dataset was selected preferentially as the BTV and is calculated such that 95% of observations from the background dataset are less than or equal to the statistic (which is the 95% upper confidence limit of the 95th percentile of the dataset) with 95% confidence. The BTV calculations are presented in Appendix W of the RI Report.

and central tendency of Site concentrations are similar to or less than background. The above comparisons of Site and background data are summarized in **Table 5-1**. The comparisons of Site and background concentrations were used to inform the BERA risk characterization, but were not used to dismiss any COPCs from the BERA.

The maximum EPC (i.e., the lower of the selected UCL or maximum detected concentration) of surface sediment COPCs identified in **Table 4-2** were compared to probable-effect ESVs (presented in **Table 4-1**), which were identified using a hierarchy of the following sources:

- Consensus-based probable effect concentrations (PECs) developed by MacDonald, et al. (2000)
- Freshwater sediment values, presented by NOAA in the Screening Quick Reference Tables (SQuiRTs) (Buchman, 2008)
- USEPA Region 4 freshwater sediment Refinement Screening Values (USEPA, 2018)

HQs were calculated for each COPC by dividing the EPC by the ESV. HQs above 1 indicate the potential for risk to benthic invertebrates. The results of this sediment benchmark screening are presented in **Table 5-1**. In addition, a sample-by-sample screen of surface sediment samples in the Waterside Investigation Area is provided in Table 1 in **Attachment I** and includes comparisons to PECs and BTVs. The results are discussed below.

**Inorganic COPCs**

Of the metals selected in the COPC screen, all were detected in each sample in the Waterside Investigation Area with the exception of antimony (83 detected concentrations out of 84 samples total). Maximum EPCs for antimony, barium, and nickel exceed the probable-effect ESVs with HQs ranging from 1.1 to 1.5. A probable-effect ESV is not available for cyanide, and comparisons of the maximum EPCs for cyanide are greater than the low-effect ESV (HQ of 10). Background levels of barium and cyanide are also higher than the probable-effect ESV, and the maximum EPCs for barium and cyanide are less than the BTVs.

Barium exceeded the probable-effect ESV at most sampling locations, but was elevated above the BTV mostly at locations contained in the Cove. Antimony exceeded the probable-effect ESV and the BTV at only one location in the Cove (SED7F). Nickel exceeded both the probable-effect ESV and the BTV at eight locations in the Cove.

Probable-effect ESVs are not available for beryllium, thallium, and vanadium. Beryllium and vanadium exceeded the BTV at locations throughout the Waterside Investigation Area. Thallium exceeded the BTV at three locations, two of which are in the Cove area.

**Pesticides**

Pesticide compounds were detected in most of the samples analyzed for these compounds in the Waterside Investigation Area. For the majority of pesticide compounds, the maximum EPCs were less than the probable-effect ESVs. Maximum EPCs (represented by UCLs) for 4,4'-DDT and chlordane were higher than the probable-effect ESVs for these compounds (HQs of 2.7 and 4.1, respectively). Several 4,4'-DDT concentrations exceeded the BTV at locations throughout the Waterside Investigation Area in the channel.

Median Site concentrations of chlordane were found to be lower than median background concentrations based on the population test presented in the Background Evaluation (Appendix W). In addition, the range of concentrations in Site and background samples overlapped (as illustrated in the boxplots presented in Appendix W), chlordane concentrations detected in background also exceeded the probable-effect ESV, and the maximum Site EPC is less than the BTV.

**Total PCBs**

Total PCBs Aroclors were detected in 83 out of 84 surficial sediment samples in the Waterside Investigation Area. The maximum EPC for total PCBs Aroclors (UCL; 0.475 mg/kg) was less than the probable-effect ESV (0.676 mg/kg). Overall, concentrations of total PCBs Aroclors in the Waterside Investigation Area overlapped with the range of background concentrations, and at many locations throughout the Waterside Investigation Area, concentrations were below the BTV (**Attachment I, Table 1**). However, in some cases, in particular at locations in the Cove, total PCB Aroclor concentrations were greater than both background concentrations and the probable-effect ESV.

Total PCB congeners were detected in all 32 sediment samples which were analyzed for PCB congeners in the Waterside Investigation Area. The maximum EPC for total PCB congeners (2.5 mg/kg) was higher than the probable-effect ESV (0.676 mg/kg). Similar to total PCB Aroclors (described above), concentrations of total PCBs congeners in the Waterside Investigation Area overlapped with the range of background concentrations, and at many locations throughout the Waterside Investigation Area, concentrations were below the BTV (**Attachment I, Table 1**). The highest concentrations of total PCB congeners were also measured in samples collected in the Cove, where concentrations were greater than both background concentrations and the probable-effect ESV.

**SVOCs**

Two methods were used for the analysis of SVOCs: Method 8270 and Method ID-0016. The SVOC COPCs were detected in most surface sediment in the Waterside Investigation Area with frequencies of detection ranging up to 100%. Based on Method 8270, the maximum EPCs for all SVOCs were less than the probable-effect ESVs with the exception of 4-chloroaniline, 4-methylphenol, bis-(2-ethylhexyl)phthalate, di-n-octylphthalate, and total HMW PAHs (HQs ranging from 1.1 to 19). In addition, maximum background concentrations exceeded the probable-effect ESVs for these compounds except 4-chloroaniline. Because of the low frequency of detection of 4-chloroaniline (detected in only 2 of 14 Site samples), it is unlikely this compound is driver of ecological risks in the Waterside Investigation Area. Based on the population test comparing Waterside Investigation Area and background, total HMW PAHs were found to be similar to or less than background.

Based on the Method ID-0016, the maximum EPCs for all compounds were less than the probable-effect ESVs with the exception of total HMW PAHs (HQ of 1.7). The maximum Waterside Investigation Area EPC for total HMW PAHs was less than the BTV, and background concentrations of this SVOC also exceeded the probable-effect ESV. The maximum EPCs for 2,3,5-trimethylnaphthalene and 2,6-dimethylnaphthalene were higher than the BTVs for these compounds.

**Dioxin/Furans**

Dioxins are not toxic to invertebrates because dioxins express their toxicity through a cellular transcription factor called the aryl hydrocarbon receptor (AHR). Invertebrates possess the AHR, but are not able to bind dioxins or dioxin-like compounds, unlike the vertebrate version (homolog). This is a widely demonstrated biological phenomenon (Butler et al., 2001) that has been reviewed and incorporated into USEPA (2008b) guidance. Therefore, a benthic invertebrate screening value was not applied to dioxin and furan compounds, but these compounds were evaluated in comparison to background concentrations.

Dioxin and furan compounds were detected in the majority of the 41 Waterside Investigation Area samples in which these compounds were measured. Maximum EPCs exceeded the BTVs for most compounds, although the ranges of Site and background concentrations overlapped. Concentrations of 1,2,3,7,8-pentachlorodibenzo-p-dioxin, 2,3,4,6,7,8-hexachlorodibenzofuran, and 2,3,4,7,8-pentachlorodibenzofuran exceeded the BTV at more locations than other dioxin and furan compounds. Based on the population test comparing Waterside Investigation Area and background, concentrations of octachlorodibenzodioxin in the Waterside Investigation Area were found to be similar to background. Therefore, with the exception of elevated levels detected in samples near the Cove, concentrations of dioxin and furan compounds were similar to background.

**Screening Summary**

The sediment benchmark screening indicates that there are a small number of COPCs that exceed both probable effects ESVs and BTVs in the Waterside Investigation Area. Exceedances of both ESVs and BTVs were generally limited to a few locations in the Cove.

### 5.1.2 Sediment Quality Triad

The Sediment Quality Triad framework evaluated potential benthic community effects in the BAZ by integrating the six measurement endpoints described in Section 3.3 (i.e., sediment COPC distribution and bioavailability in sediment and pore water, benthic community evaluation, and sediment toxicity).

To conduct the Sediment Quality Triad evaluation, sediment samples were collected from 15 locations within the Waterside Investigation Area and five upstream background locations. COPC concentrations and bioavailability were measured in BAZ sediment (Sections 4.1 and 4.2.1) and co-located pore water samples (Section 4.2.4). The benthic invertebrate community was assessed at each sediment location (Section 4.2.3). Two invertebrate species (an amphipod [*Hyalella azteca*] and a midge [*Chironomus dilutus*]) were exposed to sediment aliquots to measure potential sediment toxicity based on sublethal and lethal endpoints (Section 4.2.2). The results of these analyses, when considered in total, suggest that while there are instances of sediment toxicity, there is no clear relationship between COPCs and toxicity, and the conditions in the Waterside Investigation Area are similar to the Site-specific background. These lines of evidence are discussed below and summarized in **Table 5-2**.

#### 5.1.2.1 Sediment Benchmark Screening

COPC concentrations are presented in a sample-by-sample screening of the 15 Waterside Investigation Area samples and five background area samples in **Table 5-3**. Exceedances of both low-effect and probable-effect ESVs are generally limited to a small number of locations in the Cove for metal COPCs, but are below the probable-effect ESV in the channel. Pesticide concentrations lacked a spatial trend in the Waterside Investigation Area, and concentrations exceeded the low-effect ESVs at most Waterside Investigation Area and background locations. Total PCB Aroclors and congeners concentrations were higher than the low-effect ESV at all Waterside Investigation Area sample locations and most background sample locations; in the Waterside Investigation Area, the highest total PCB Aroclors concentrations were detected in the Cove. Similar ranges of SVOC concentrations and frequencies of exceedances of the low-effect and probable-effect ESVs were observed for Waterside Investigation Area and background samples. With the exception of elevated levels detected in samples near the Cove, concentrations of dioxin and furan compounds were similar to background.

Select COPC concentrations of the 15 sediment samples collected in 2017 (Phase II) were compared to the sediment samples collected in the remainder of the Waterside Investigation Area to determine if the two datasets are comparable (this evaluation is presented in **Attachment K**). The results of this analysis indicated that there are no statistical differences between the 2017 Phase II data and data for the remainder of the Study Area for total PCBs (Aroclors), total PAHs, DDE, and percent fines. Concentrations of total PCB congeners and TOC are higher in Phase II samples than in the rest of the Study Area. The difference in TOC is expected based on the differences in habitat of the shallower, slower moving water of the Cove where half of the Phase II samples were collected versus the main channel of the River. The differences in total PCB congeners may be related to the difference in datasets compared (only 6 Phase II samples compared to 21 samples in the remainder of the Study Area).

#### 5.1.2.2 Evaluation of Pore Water Chemistry

Three dissolved metals (barium, iron, and manganese), one total phase metal (iron), and one SVOC (pyrene) were identified as COPCs (**Table 4-10**). A sample-by-sample screening of the pore water COPCs in the 15 pore water samples in the Waterside Investigation Area and five background samples (which are co-located with the sediment chemistry, bioassay, and macroinvertebrate community survey samples) is provided in **Attachment I** (**Table 2**). Most Waterside Investigation Area and background pore water concentrations exceeded the chronic surface ESVs for the metals, but the ranges of concentrations of these metals in pore water samples from the Waterside Investigation Area were less than the ranges of concentrations measured in background location pore water samples.

Pyrene was also detected in all Waterside Investigation Area and background pore water samples; pyrene levels were higher than the chronic ESV at six out of 15 Waterside Investigation Area locations and one background location. As indicated by the evaluation of the bioavailable fraction of PAHs in pore water (Section 4.2.5), the ∑EqPTU values were less than 1 in all Waterside Investigation Area and background samples with the exception of SED7B, which is the location with the highest pyrene concentration detected in pore water.

#### 5.1.2.3 PEC Quotients and COPC Bioavailability

Ratios of COPC concentrations to the probable-effect ESV (PEC quotient or PEC-Q) were computed to determine if COPCs were present above the probable-effect or severe-effects level in BAZ sediment; PEC-Qs greater than 1 would indicate a higher probability of COPC-driven toxicity. Mean metal PEC-Qs were calculated for each sample as the average of individual metal concentrations divided by the metal-specific PEC for arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Total PCB Aroclor and congener PEC-Qs and 4,4'-DDE PEC-Qs were also calculated per sample. COPC bioavailability (i.e., divalent metal bioavailability [Section 4.2.1] and bioavailability of PAHs in sediment and pore water

[Section 4.2.5]) was also considered in this analysis, as bulk COPC concentrations are poor predictors of toxicity. The results of this analysis are presented in **Table 5-2** and indicate that:

- Mean metal PEC-Qs are less than 1 and the (∑SEM-AVS)/$f_{oc}$ values are less than 130 μmol/$g_{oc}$, which suggests that metals would not likely cause toxicity in BAZ sediment in the channel, Cove, or background locations.
- PCB Aroclor PEC-Qs are less than 1 at all locations with the exception of SED7.5E (PCB PEC-Q of 1.2), which was located in the Cove. Growth of both midges and amphipods was significantly lower at this location. PCB congener PEC-Qs are less than 1 at all locations with the exception of SED7.5E (PCB PEC-Q of 2.1) and SED7F (PCB PEC-Q of 1.5). At SED7F, low growth was noted for midge and amphipods and the benthic community B-IBI result at SED7F suggested a degraded community.
- 4,4'-DDE PEC-Qs are less than 1 at all locations with the exception of SED7B (4,4'-DDE PEC-Q of 1.3), which is located in the channel. Growth of both midges and amphipods was significantly lower at this location.
- The ∑ESBTU and ∑EqPTU values are all less than 1 with the exception of SED7.5D, for which the ∑ESBTU is greater than 1 but the ∑EqPTU is less than 1, and SED7B, for which both the ∑ESBTU and ∑EqPTU values are greater than 1.

The results of the COPC evaluation reveal few COPCs in exceedance of respective PECs, and evidence from the bioavailability evaluations suggests that divalent metals and PAHs present in the Waterside Investigation Area are not bioavailable at most locations.

#### 5.1.2.4 Evaluation of Benthic Invertebrate Community Survey

The benthic community was dominated by a few taxa at both Waterside Investigation Area and background locations, with the greatest species richness observed at Waterside Investigation Area locations SED6A and SED7A and the lowest species richness at background location SED19. Worms (*Limnodrilus* spp.), Asiatic clams, Nematoda, and the chironomids *Tanypus neopunctipennis* and *Chironomus decorus* were the most abundant organisms at both Waterside Investigation Area and background locations. As illustrated in **Figure 4-4**, three general groupings were identified based on similarity of numbers of taxa: Waterside Investigation Area sediment samples located in the Cove, Waterside Investigation Area samples in the channel, and a third group consisting of upstream background and two Waterside Investigation Area samples in the channel. A statistical analysis of COPC concentrations measured in the fifteen Phase II 2017 samples collected in the Cove versus the channel indicated that concentrations of most chemicals are comparable in these two areas; however, boxplot comparisons illustrate higher median total PCB Aroclor and total PAH concentrations in the Cove samples (**Attachment K**).

Insufficient samples are available to compare concentrations of total PCB congeners in the Cove and the channel (**Attachment K**). Therefore, the use of PCB Aroclor results may underestimate EPCs as estimated by PCB congener analysis, and the use of PCB totals based on Aroclors results in some uncertainty in the sediment benchmark screening (Section 6.1.8). In short-term bioassays, three samples from the Cove and two samples from the main channel had reduced growth responses for both chironomids and amphipods relative to at least one background sample (Section 5.1.2.5).

The Chesapeake Bay B-IBI scores (**Table 5-2**) indicate that most Waterside Investigation Area samples are considered marginal to "meets restoration goals" with the exception of SED8C, which was categorized as severely degraded. However, all background locations had scores of 2.67 or less, indicating marginal to severely degraded. Reduced growth in the sediment toxicity tests was observed in SED8C for both amphipods and midges compared to one background location for amphipods and two background locations for midges. As indicated by the summary of chemistry results in **Table 5-2**, the mean metal PEC-Q, PCB PEC-Q, ($\sum$SEM-AVS)/$f_{oc}$ value, and $\sum$ESBTU and $\sum$EqPTU values are less than 1 (or 130 µmol/$g_{oc}$ for ($\sum$SEM-AVS)/$f_{oc}$) at SED8C, indicating little to no potential for toxicity related to chemistry. In addition, the physical properties (grain size and TOC) at SED8C appear to be within the range of these values measured at both Waterside Investigation Area and background locations. Therefore, the reduced growth and low B-IBI at SED8C may be related to other stressors in the system.

The results of the macroinvertebrate community survey are consistent with previously conducted community surveys. Due to the development of the watershed surrounding the river, particularly inputs via combined sewer overflows resulting in degraded water quality and river substrate, the benthic community of the Anacostia River has been characterized by low diversity, low abundance, and dominance by pollution-tolerant worms (AWTA, 2002). Benthic community sampling conducted by the USFWS at 20 stations within the Anacostia River found that all locations were dominated by oligochaetes, which ranged from 42% to 92% of the organisms at a given station, and results of the B-IBI indicated that 8 of 20 stations (40%) were classified as "degraded" (B-IBI < 3). Both USFWS (McGee et al., 2009) and Tetra Tech (2018) have reported no clear relationships between benthic community health and concentrations of constituents in sediment. This same finding is supported by the results of the benthic macroinvertebrate community survey, which indicated a healthier community within the Waterside Investigation Area than in the upstream background locations.

#### 5.1.2.5 Sediment Toxicity

Overall, survival and growth of both test species were similar among samples located in the Cove, channel, and upstream background areas. Growth and survival of midges and survival of amphipods was similar to the laboratory control; amphipod growth was 11% lower in the Cove, 14% lower in the channel, and 12% lower in the background area than the laboratory control (**Figure 5-1**). However, the biological significance of this result is not known, as laboratory controls only report a single value for an endpoint that likely fluctuates normally (Ruden et al., 2016).

Amphipod and midge survival responses were similar among background and Waterside Investigation Area samples (**Table 4-4** and **Table 4-5).** Only one sample had significantly lower amphipod and midge survival rates than the laboratory control: the background location SEDBACK16. Midge survival was somewhat lower than the laboratory control at location SED6.5D. No other samples had survival rates than laboratory controls. Only one location (SED7B, located in the channel) had reduced amphipod survival relative to two background samples. There were no differences among Waterside Investigation Area and background samples for midge survival.

Greater differences were observed for the growth endpoints than for survival endpoints (**Table 4-4** and **Table 4-5**). Midge growth was different from laboratory controls in only two of 15 samples at locations SED7.5E (Cove) and SED7B (channel); these samples were also different from each background area sample. Amphipod growth was lower in one location from the background areas (SEDBACK16), four locations in the Cove, and five locations in the channel. For the majority of Waterside Investigation Area samples (10 of 15 samples), growth was not significantly reduced compared to most (i.e., three to four) background samples. For the amphipod test, reduced growth was observed in Site sample SED7B relative to three background samples; several other samples relative to sample SEDBACK20 were different from the background area.

Correlation analysis was performed for COPCs with PEC-Qs greater than 1 in at least one location to compare Waterside Investigation Area and background sample toxicity test results for amphipods and midges with sediment chemistry, TOC, and percent fines (**Table 5-4**). Survival of both amphipods and midges were not related to any physical or chemical parameter; midge survival was correlated with total PCB Aroclors, but this relationship was positive and thus questionable. Midge growth was correlated with a number of physical (percent silt, clay, and fines) and chemical (total PCBs, PAH toxic units in sediment and pore water, and 4,4’-DDE) parameters (**Figure 5-2**).

Total PCB Aroclors and DDE exceeded the PEC in only one sample (**Table 5-2**). PAHs are negatively and significantly correlated with midge growth; however, pore water evaluations indicate that PAHs are not bioavailable. In addition, there were no relationships between B-IBI and any parameter, indicating that COPC distributions do not appear to be altering the benthic community structure. Further evidence of this is provided by the background area samples, which had only one sample that had lower amphipod growth than the laboratory control, but had lower B-IBI scores (Section 4.2.3). This indicates that parameters other than COPC distribution are likely driving the low levels of sediment toxicity.

Physical parameters may be important to the interpretation of the toxicity results. Midge growth is strongly related to percent fines (**Figure 5-2**). Fine-grained sediment has been shown to potentially cause adverse effects in invertebrates (Wood and Armitage, 1997). Based on the statistical comparisons between Waterside Investigation Area and background samples (presented in Section 4.2.2), amphipod and midge survival and growth results for the background sample SEDBACK16 were significantly lower than the laboratory control and many Waterside Investigation Area samples. These results are likely related to the physical properties of this location: TOC measured at SEDBACK16 (14%) was higher than all other Waterside Investigation Area and background samples.

As described in Section 4.2.2, the amphipod and midge tests are based on a 10-day test duration, which limits the interpretation of potential longer-term chronic impacts. However, these sediment bioassays are one of several lines of evidence included in this BERA to evaluate potential impacts to the benthic invertebrate community. In addition, chronic impacts to the benthic community are also evaluated in the benthic community survey (Section 4.2.3) in which chronic exposures are expected to result in degraded benthic communities. Longer duration amphipod tests were included in the ARSP RI, and the results of these tests for the six sampling locations in the Waterside Investigation Area (described in Section 4.2.2.3) indicated some impacts for growth and reproduction endpoints based on the longer duration amphipod tests (although reproduction was not the most sensitive endpoint). However, only one ARSP location (R6-21) is located in the Cove, which limits the comparisons between ARSP and Pepco toxicity tests presented herein. The uncertainties related to test duration are further discussed in the Uncertainty Evaluation (Section 6.1.5).

### 5.1.3 Benthic Invertebrate Weight of Evidence Evaluation

Multiple lines of evidence were considered relative to the potential for benthic invertebrate risk from exposure to COPCs in surficial sediment.

- Concentrations of several constituents (e.g., total PCBs, metals, and pesticides) in surficial sediment exceed literature-derived benthic macroinvertebrate screening values in both the Waterside Investigation Area and the background area reaches of the Anacostia River evaluated in this BERA. However, the median PEC-Q was less than 2 for all COPCs, with the exception of chlordane, which had a median PEC-Q of 2.6.

- Several compounds (e.g., total PCBs) were present at slightly higher concentrations in the Cove than elsewhere in the Waterside Investigation Area. However, the ranges of concentrations for most COPCs throughout the Waterside Investigation Area are similar to the ranges detected in background samples and to background threshold values.
- The results of the divalent metals (cadmium, copper, lead, nickel, and zinc) and PAHs (34 constituents) bioavailability analysis demonstrate that these constituents are not bioavailable in surficial sediment and therefore are not stressors of concern, with the possible exception of PAHs at one sampling station (SED7B).
- Evaluation of surficial sediment pore water indicates, with only a few exceptions (barium, iron, and manganese), that constituents are not present in pore water at concentrations that pose an ecological concern, and further, that concentrations of pore water constituents in the Waterside Investigation Area and the background area are similar. PCBs were not present in pore water at concentrations indicative of ecological risk.
- The benthic community survey results, which provide a Site-specific, field-based metric of community health, generally demonstrated no impacts associated with exposure to COPCs in the Waterside Investigation Area. In fact, the majority of benthic samples collected from the Waterside Investigation Area was more diverse and had higher bioassessment scores than samples collected from the background area.
- The toxicity testing results included lethal (survival) and sub-lethal (growth) measurements. In general, amphipod and midge survival responses were similar among the five upstream background samples and the 15 Waterside Investigation Area samples. Only one sample (SED7B, located in the channel) had reduced amphipod survival relative to two upstream background samples. There were no differences between Waterside Investigation Area and background samples for midge survival. Reduced amphipod growth was observed in Site sample SED7B relative to three background samples. Two site samples, SED7B (collected in the channel) and SED7.5E (collected in the Cove), had reduced growth responses for amphipods and/or chironomids relative to most or all background sample responses.

The results of the toxicity tests and co-located results for analytical, physical, and community survey sampling results were evaluated on a sample-by-sample basis to determine if any spatial trends are apparent among the parameters measured. For three of four toxicity endpoints (survival of both amphipod and midge, and amphipod growth), no significant trends in chemistry, physical characteristics, and toxicity were observed among Waterside Investigation Area and background locations. Midge growth was significantly and negatively correlated to percent fines, total PCB PEC-Qs, and PAH TUs in sediment and pore water. However, the total PCB and PAH correlations are not toxicologically relevant, since all but one sample contained PCBs at concentrations below the PEC (total PCB PEC-Q less than 1) and PAH toxic units below 1 (total PAH TU quotient less than 1). Correlation with grain size, therefore, may be more meaningful than the COPCs, as grain size controls the distribution of hydrophobic organic compounds like PCBs and PAHs, and can exert direct deleterious effects at high proportions of fine-grained sediment.

## 5.2 Assessment Endpoint 2: Fish Community Risk Characterization

Fish may potentially be exposed to COPCs from direct contact with surface water and sediment and ingestion of sediment and contaminated food items. The results of the surface water screen presented in the Preliminary BERA indicated that there is no potential for risk to fish based on direct contact with surface water.[8] As indicated in **Table 4-13**, fish tissue maximum and average detected concentrations are less than the maximum NOEC and LOEC CBRs for all COPCs. DOEE evaluated fish tissue concentrations relative to a range of fish tissue CBRs to support the ARSP RI, and the EPCs in this evaluation also fall well below the maximum CBR concentrations identified by Tetra Tech (2018). The maximum detected concentrations of PCBs are predicted to have significant growth, reproduction, and mortality impacts to less than 0.5% of fish species included in Berninger and Tillett (2019).

Whole body fish tissue COPC concentrations in fish tissue samples collected in the vicinity of the Study Area (i.e., Exposure Unit 3 samples collected from an approximate 2.8-mile area centered on the Study Area) were compared to samples collected downstream (i.e., downstream of the CSX bridge) and upstream (i.e., upstream of the Kenilworth Park Landfill) of the Study Area. The fish tissue samples for Exposure Unit 3 and upstream and downstream are detailed in Section 2.5, and sampling locations are presented on **Figure 2-3**. This comparison indicates that the range of fish tissue concentrations detected in samples collected in the vicinity of the Waterside Investigation Area are generally similar to ranges of concentrations detected in fish tissue samples collected downstream and upstream of the Waterside Investigation Area (**Figure 5-3**).

## 5.3 Assessment Endpoint 3: Wildlife Community Risk Characterization

As indicated in **Table 4-15**, all HQs for the belted kingfisher, great blue heron, and raccoon were well below or equal to 1 for the most conservative exposure scenarios (i.e., considering maximum EPCs and NOAEL- and LOAEL-based TRVs).

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[8] The surface water and groundwater-to-surface water evaluations presented in the Preliminary BERA are included as **Attachment L**.

The HQs represent a conservative estimate of potential risks because the food chain model assumes that both receptors are present year-round and only consume food items from within the Waterside Investigation Area. As illustrated in **Figure 5-3**, COPC concentrations measured in fish tissue samples collected near the Waterside Investigation Area are similar to COPCs in fish tissue samples collected downstream and upstream of the Study Area. Therefore, risks to birds and mammals from food chain exposure to COPCs within the Waterside Investigation Area are not expected.

# 6 Uncertainty Evaluation

The objective of the uncertainty evaluation is to discuss the assumptions of the BERA process that may influence the risk assessment results and conclusions. Although it is not practical to account for all sources of uncertainty, it is important to identify and address the major elements of uncertainty in the risk evaluation and assessment. Some uncertainties bias the results of the risk assessment toward over-estimating the risk, while others bias toward under-estimating the risk. The sources of uncertainty in this BERA are discussed in the sections below.

## 6.1 Uncertainties Associated with the Benthic Community Evaluation

There are several sources of uncertainties associated with the lines of evidence considered for the benthic community risk characterization, including the overestimation of risks due to the differences in sampling depths, the temporal and spatial variability in sediments, conservative ESVs, the lack of ESVs for certain COPCs, the bioavailability of COPCs in sediment and pore water, and uncertainties associated with sediment toxicity tests. These sources of uncertainties are discussed in the following sections.

### 6.1.1 Uncertainties Associated with Differences in Sampling Depths

The surficial sediment samples collected by Pepco for the Phase I RI in 2013 (described in Section 2.1) and by DOEE for the ARSP in 2014, 2015, and 2016 (described in Section 2.4) were collected from a depth of 0 to 15.2 cm (0 to 0.5 ft) below sediment surface. The sample depth for the Phase II RI surficial sediment samples was 0 to 10 cm (0 to 0.33 ft) based on the results of the SPI survey conducted at the 15 near-Site sample locations and the five upstream background locations in 2017 (described in Section 2.2; the SPI survey is presented in **Attachment C**). The SPI survey results indicated that biological activity (e.g., evidence of gas voids, observations of infauna) is confined to the first 10 cm of sediment. As indicated in the comparison of summary statistics for the 0 to 15.2 cm sediment samples and 0 to 10 cm sediment samples presented in **Table 6-1**, higher mean and maximum concentrations of organic COPCs were generally detected in the deeper (0 to 15.2 cm) samples from Phase I compared to the 2017 samples (0 to 10 cm). For inorganic COPCs, the mean concentrations in the deeper samples are lower than mean concentrations in the more recent, shallower samples, but the reverse is true for the maximum concentrations of most metals. The standard deviation of the majority of COPCs is higher in the deeper (0 to 15.2 cm) samples compared to the 2017 samples (0 to 10 cm), suggesting that concentrations were more variable with depth. Therefore, the higher concentrations for most COPCs and the higher variability associated with the deeper Phase I RI samples and the ARSP samples may overestimate the concentrations of COPCs to which benthic organisms may be exposed.

### 6.1.2 Uncertainties Associated with Temporal Variability

The sediment samples considered in the WOE risk evaluation for benthic receptors were collected in 2017 (for the Phase II RI) at sampling locations that had been previously characterized in 2013 for the Phase I RI. These locations were selected to provide both a broad concentration range and spatial coverage of the Waterside Investigation Area. For some COPCs, higher concentrations were observed at these stations in 2013; however, for other COPCs, higher concentrations were detected in the 2017 sampling round. As summarized in Section 5.1.2.1, comparisons between the Phase II sediment samples and the samples in the remainder of the Study Area that were collected prior to 2017 indicated that COPC concentrations and percent fines were similar (statistical evaluation is presented in **Attachment K**). While this temporal variability introduces some uncertainty into the risk characterization process, it is not likely to change the risk assessment findings relative to these receptors.

### 6.1.3 Uncertainties Associate with ESVs

The sediment ESVs considered in the BERA were derived from sources typically used in screening level ERAs (e.g., low-effect ESVs) and therefore represent conservative values that may overestimate risks. These values are useful in identifying areas or media where no adverse ecological effects would be expected and which can then be eliminated from further consideration.

The ESVs used to screen the analytical data do not generally account for possible synergistic, antagonistic, or additive effects of contaminant mixtures in environmental media. These factors may result in an underestimate or overestimate of potential risk. The ESVs used in this evaluation are based on direct or indirect toxicity, and do not consider bioaccumulation or bioavailability. This limitation may result in an underestimate of potential risks. However, there are many potential binding phases for COPCs that may limit bioavailability in various media, and the assumption of 100% bioavailability likely overestimates risk. The evaluation of SEM, AVS, and TOC data and PAHs in pore water provides estimates of bioavailability beyond the evaluation of the bulk sediment data alone.

Screening values based on studies conducted under laboratory conditions are useful in attempting to find an environmental concentration protective of all species; however, many physicochemical characteristics of soil, sediment, and water alter the concentration-response relationships, and conditions in the laboratory may not be reflected in the field. Most commonly, pH, organic matter content, texture, and relative amounts of other substances (e.g., calcium, iron) influence bioavailability and, therefore, the threshold concentration for a particular field situation (Kapustka et al., 2004). Weathered materials found in sediments are likely to be less bioavailable than the materials used in laboratory studies. As noted in the Preliminary BERA, the probable-effect ESVs derived from PECs (MacDonald et al., 2000) and UETs (Buchman, 2008) are based on 1% TOC and may over-estimate risks within the exposure area where average TOC is higher than 1% (median TOC is 4.05%). Therefore, potential risks may be overestimated by the screening values.

The derivation of screening values typically includes conservative assumptions, such as the application of safety factors. The safety factor is intended to account for low predicted toxicity (i.e., using a lower concentration than what was measured with associated effects) and bioaccumulation to higher trophic level aquatic organisms (i.e., the guidelines were not derived for bioaccumulation, and lower concentrations are assumed to be more protective to higher trophic levels). The safety factor likely overestimates potential risks to the benthic invertebrate community.

Sediment ESVs were not identified for beryllium, thallium, vanadium, acetophenone, caprolactam, 2,3,5-trimethylnaphthalene, and 2,6-dimethylnaphthalene. It was assumed that the evaluation of other COPCs within these chemical classes (i.e., metals and SVOCs) sufficiently captures the majority of the potential risks at the Waterside Investigation Area. Caprolactam was detected in only one out of 14 Waterside Investigation Area samples. In addition, all of these COPCs were evaluated in the Background Evaluation (Appendix W of the RI Report). Finally, the potential for risks to benthic organisms was evaluated based on the combined outcome of several lines of evidence (sediment COPC distribution and bioavailability in sediment and pore water, benthic community evaluation, and sediment toxicity), and as such, integrates exposure across all COPCs in the evaluation.

### 6.1.4 Uncertainties Associated with SEM and AVS Data Evaluation

Many of the uncertainties related to temporal and spatial variability in the evaluation of AVS and SEM relationships are outlined in USEPA (2000) and Besser et al. (1996). AVS formation is affected by a number of abiotic and biotic factors, including microbial activity, temperature, oxidation-reduction conditions, sediment resuspension, seasonal changes, and sulfate concentrations. Efforts were made during sediment sample collection to minimize oxidation (i.e., no headspace in the sample container); however, some oxidation may have occurred during collection, and as a result, AVS levels may be underestimated in this evaluation. This would result in higher SEM/AVS ratios and thus would conservatively estimate the risk associated with metals. However, in cases of low AVS concentrations, other binding phases may also play a role in moderating bioavailability, e.g., in these samples, the $(\sum SEM\text{-}AVS)/f_{oc}$ conclusions indicate that binding by TOC plays a large role.

The SEM/AVS methodology is also based on equilibrium partitioning theory, which assumes a steady-state system (USEPA, 2000). This assumption may or may not be as valid in field conditions as it is in laboratory tests of the method. The SEM/AVS methodology does not take into account possible toxicity from any other inorganic constituents detected in the sediment, and does not explicitly consider bioaccumulation. Also, the evaluation of these data is applicable only for the pathway for which it was developed (direct toxicity to benthic organisms from divalent metals) and is not applicable to alternate exposure pathways.

There are also uncertainties associated with the evaluation of ($\sum$SEM-AVS)/$f_{oc}$. Normalization of SEM-AVS to fraction organic carbon reduces the variability in exposure assessments, especially in laboratory experiments. There is some uncertainty in extrapolating these relationships into field conditions. In particular, there is evidence that the effect of organic carbon on bioavailability depends on the nature of the organic carbon (such as when the organic carbon is present as biological complexes that would tend to increase bioavailability; USEPA, 2005).

### 6.1.5 Uncertainties Associated with Toxicity Testing

The results of toxicity tests can be used to evaluate potential effects on aquatic receptors in situ, but it is important to recognize that:

- Mobile organisms may be able to avoid prolonged exposure to contaminated media.
- Although the tests are designed to predict adverse effects on biological communities based on chronic exposures, they are not multi-generation chronic tests, in that they do not consider population effects by assessing potential effects over several generations during the test period.
- Toxicity to organisms in situ may be dependent on physical characteristics and chemical equilibrium partitioning that are not replicated under laboratory conditions.

The species used in toxicity testing programs are assumed to be representative and to be protective of the organisms that may be found on site, but the use of surrogate species cannot precisely predict the health of ecological communities on site.

Laboratory toxicity tests are normally conducted with species that are sensitive to constituents in the media of exposure. Guidance manuals from regulatory agencies contain lists of these organisms that they consider to be sensitive enough to be protective of naturally occurring organisms at a site. However, reaction of all species to a COPC is not known, and species found within the Anacostia River might be more or less sensitive than those used in laboratory toxicity testing.

Species introduced to test media have not been acclimated to site-specific conditions. Species found within a particular site have usually been naturally acclimated to certain physical and chemical conditions and potential stressors. When organisms from a controlled laboratory environment are introduced to external media, they are often more susceptible to these stressors, and may have adverse reactions that are not indicative of the responses of organisms present at the site. In addition, field and laboratory manipulation of sediment prior to the introduction of laboratory test organisms may alter the bioavailability of a COPC. Sediment in its native state is often at some degree of chemical equilibrium. When samples are collected, they are homogenized, sieved, and otherwise handled prior to testing. This can alter the bioavailability of a COPC, making it more or less available to test organism exposure.

The statistical evaluations presented in **Table 4-4** and **Table 4-5** identify Waterside Investigation Area samples with responses that were statistically below the responses of the laboratory control sample and/or the five background samples. However, these statistical differences may not be ecologically significant. The ecological relevance of the sediment toxicity testing results should be considered as part of risk management.

If a toxic impact is observed in a toxicity test, there may or may not be a causal relationship between the toxic effect and measured chemical concentrations in the sediment. As indicated in Section 5.1.2, low toxicity was observed in the majority of Waterside Investigation Area samples, and there is limited evidence that COPC concentrations in sediment are correlated with observed toxicity.

The amphipod toxicity tests are based on a 10-day test duration, which may not capture longer term growth or reproduction impacts that could affect invertebrate populations. According to the ASTM guidance for the amphipod and midge toxicity tests (ASTM 2010), significant lethal or sublethal effects may be difficult to discern at moderate levels of sediment contamination during a shorter-term test (i.e., 10-day duration), but the results of short-term tests can be used to identify the need for further evaluation of sediment toxicity. In addition, the results of sediment toxicity tests should be interpreted along with other lines of evidence using a weight of evidence approach (ASTM, 2010). The sediment bioassays for midge and amphipod are one of several lines of evidence included in this BERA to evaluate potential impacts to the benthic invertebrate community, including the benthic community survey (Section 4.2.3) which captures long-term chronic impacts by evaluating the health of the community relative to established biological metrics (e.g., the Chesapeake Bay B-IBI). Longer duration amphipod tests were included in the ARSP RI, and the results of these tests for the few sampling locations in the Waterside Investigation Area are discussed in Section 4.2.2.3.

### 6.1.6 Uncertainties Associated with Pore Water Evaluation

The surface water ESVs, which were used in the pore water evaluation, were derived from sources typically used in screening-level ERAs (e.g., DOEE WQS) and therefore represent conservative values that may overestimate risks. These values are useful in identifying areas or media where no adverse ecological effects would be expected and which can then be eliminated from further consideration. However, ESVs are often based on studies conducted in the laboratory and may not accurately represent field conditions. Chemical forms of COPCs used in toxicity testing may be more bioavailable than the COPCs found in the field, and lab conditions are unlikely to represent the variable conditions found in the field. This extrapolation to field pore water conditions represents an unknown source of bias in the BERA.

The ESVs used in this BERA for pore water are based on chronic effects to analyze the potential for ecological risk to freshwater fish communities. Chronic toxicity values were used because it was assumed that pore water and sediment indicator species would experience continuous exposures within the aquatic exposure area. The assumption of chronic exposure may be realistic for the sediment-associated species (i.e., amphipods) and small juvenile fish, but is likely conservative for epibenthic macroinvertebrates. The ESVs are also designed to be protective of sensitive species that may not be present within the Waterside Investigation Area; therefore, this may result in an overestimate of potential toxicity for many aquatic organisms.

Toxicity data are typically not available for all species considered in a BERA, so ESVs based on surrogate species were used. It is assumed that species used to derive the ESVs are protective of other species. However, the inter-species extrapolation of toxicity data produces unknown bias in risk calculations. The selection of conservative values in the BERA (e.g., lowest surface water ESVs) helps to limit this uncertainty.

### 6.1.7 Uncertainties Associated with Bioavailable PAHs and Measured PAHs in Sediment and Pore Water

As described in Section 4.2.5, the BERA evaluated estimates of bioavailable PAHs in sediment and measured PAHs in pore water. Bioavailable PAHs were estimated according to USEPA guidance (USEPA, 2003) using the PAH-34 and TOC data.

In general, the ∑ESBTU over-predicts the bioavailability of PAHs in sediment in comparison with the ∑EqPTU results, i.e., the ∑ESBTU is generally higher than the ∑EqPTU. Typically, because the pore water analysis accounts for more site-specific binding factors, the ∑EqPTU based on measured pore water would be lower. For both calculations, most TUs were below 1 at all Waterside Investigation Area and background locations. However, in one instance, SED7.5D, the ∑ESBTU was greater than 1 but the

∑EqPTU was less than 1. A review of factors such as TOC and grain size did not identify an explanation for these results at SED7.5D.

### 6.1.8 Uncertainties Associated with Analysis for PCBs via Aroclor versus Congeners

Per the approved RI work plan, PCB Aroclor analysis was performed, and the Aroclor data were used in the BERA to characterize potential sediment exposures. The Aroclor data set is more extensive for the Waterside Investigation Area than the data set for congeners. However, due to differences in the analytical methods, the use of Aroclor versus congener data represents a potential source of uncertainty in the BERA. A subset of sediment samples were analyzed for both Aroclors and congeners, allowing for comparison of the two sets of PCB concentrations.

Thirty-one surface sediment samples in the Waterside Investigation Area were analyzed for both PCB Aroclors and PCB congeners, including four samples collected in 2013 for the Phase I RI, 12 samples collected in 2017 for the Phase II RI, and 15 samples collected by DOEE in 2014 and 2015. The ratio of total PCB congener to total PCB Aroclor ranged from less than 1 to 6.2 (**Table 6-2**), with an average of 2.2 and median of 2.0. Therefore, the use of PCB Aroclor data may underestimate EPCs as estimated by PCB congener analysis, and use of PCB totals based on Aroclors results in some uncertainty in the sediment benchmark screening. Despite this uncertainty, even if the benchmark screening was based on PCB congeners rather than PCB Aroclors, the benthic invertebrate risk characterization would likely remain unchanged. The maximum PEC-Qs for total congeners and total Aroclors are 11.8 to 3.9, respectively. However, median PCB PEC-Q based on PCB congeners remains less than 1, and the various Site-specific lines of evidence considered in this BERA (e.g., toxicity testing, benthic community sampling) integrate exposure to all COPCs in the sediment, regardless of the analytical method. Furthermore, the PCB pore water analysis focused on bioavailable congeners and found that PCB pore water concentrations were universally below surface water screening levels for protection of aquatic life, which is consistent with the findings of Ghosh et al. (2019) at Anacostia River sampling locations (i.e., PCB congener concentrations in pore water were below surface water screening levels). Therefore, uncertainty relative to the use of PCB Aroclors vs PCB congeners would not change the outcome of the benthic invertebrate risk characterization. To provide context for the RI pore water results from the Cove, other studies conducted in the river indicate that PCB pore water concentrations in the Cove are elevated in comparison to adjacent portions of the river (Ghosh et al. 2019, Tetra Tech 2018).

## 6.2 Uncertainties Associated with the Fish Community Evaluation

There are several sources of uncertainties associated with the BERA fish community evaluation, including the relevance and representativeness of the fish tissue samples collected by DOEE for the ARSP to the

Waterside Investigation Area and the determination of fish tissue CBRs. These sources are discussed in the following sections.

### 6.2.1 Uncertainties Associated with the DOEE Fish Tissue Data

The fish tissue evaluation of this BERA is based on fish tissue samples collected by DOEE in 2014 and 2015 as described in Section 2.5. No fish tissue samples were collected in the Waterside Investigation Area, but the samples were collected upstream and downstream of the Waterside Investigation Area and in Kingman Lake. The habitat of Kingman Lake differs from the main stem of the river with slower moving water and shallower water depths. Because there are no fish barriers between the main stem of the river and Kingman Lake, fish may move between these two areas and the Waterside Investigation Area. However, the extent and frequency of fish movements between the main stem of the river and Kingman Lake are unknown for all trophic level fish and may be minimal for small forage fish.

The tissue samples included forage fish, mid-level trophic level fish, and top-level (predator) fish species. In general, small forage fish do not travel relatively far for refuge or foraging; for example, sunfish typically have a small home range (e.g., 0.6 to 2.8 acres [0.23 to 1.12 hectares]; Fish and Savitz, 1983). Conversely, larger, higher trophic level fish typically move farther for resources and/or migration and their ranges can vary widely. Adult bass (*Micropterus* spp.), common sport fish in the Anacostia and other tidal rivers in the region, have home ranges on the order of 2 km (Love, 2009). The home range of the brown bullhead, the adults of which reside in the Anacostia River system throughout the year, can range from 2 km to 4 km (Sakaris et al., 2005). Therefore, it is not possible to attribute fish tissue sample results to specific conditions within the Waterside Investigation Area because it is not known whether or for how long any of the fish sampled were present in the Waterside Investigation Area. However, it may be reasonable to assume that the COPC concentrations detected in the fish tissue are generally representative of conditions throughout the approximately 2.8-mile area within which they were collected near the Site (**Figure 2-3**), and possibly more distant river reaches as well for those species that migrate or have large home ranges.

There is also uncertainty about the relationship between sediment concentrations and fish tissue concentrations. While it is assumed that fish may accumulate constituents through direct contact with sediment or dietary uptake of the sediment, the significance of sediment as a source relative to other sources (e.g., surface water, prey tissue) is unknown. The existence of rate of bioaccumulation from sediment to fish cannot be determined solely by comparing sediment concentrations to fish tissue concentrations. It cannot be fairly assumed that the relationship is linear. The actual relationship between exposure and accumulation is more complex. It is affected by mechanisms such as excretion and metabolism. In addition, the relationship is often limited by rate or concentration, meaning that organisms may accumulate faster at lower concentrations or slower at higher concentrations than a simple linear assumption would indicate (Judd et al., 2013). Additional data and analysis would be required for a more complete understanding of COPC uptake pathways and rates of bioaccumulation from sediment to fish tissue.

### 6.2.2 Uncertainties Associated with the CBRs

There are several uncertainties inherent in the determination of tissue CBRs (i.e., tissue residues representing a toxicity threshold) based on the variety of test conditions and tested species reported in the literature. In particular, the NOEC values are dependent on the experimental design (e.g., selection of exposure concentrations). The actual no-effect tissue residue concentration from a study could be higher or lower than the designated NOEC and up to the LOEC from the study.

In addition, tissue residue thresholds can vary widely across studies and species. Exposure will also vary among organisms due to differences in exposure routes, rates of uptake and metabolism, ability to detoxify constituents, and species-specific elimination kinetics (Adams et al., 2010). For example, some organisms can accumulate relatively high concentrations of metals without negative lethal or sub-lethal effects, but other organisms may exhibit such effects at the same concentration or lower (Adams et al., 2010).

In addition, lipid data were not available for the fish tissue, and were also not available for the CBRs. Therefore, although some chemicals like mercury are known to accumulate in lipids, the lack of lipid data prevents lipid normalization of the fish tissue concentrations and CBRs. Normalization to lipid levels could help to reduce uncertainties in the evaluation of the tissue data if there is variability in the lipid levels across the site-specific tissue data sets and/or the basis for the CBRs. However, without this data it is unknown what level of uncertainty is inherent in the evaluation.

Finally, a critical threshold residue does not exist for all organisms, and the selected CBRs presented in **Attachment G** are specific to the species and life stages upon which those studies were based. The species on which the CBRs were based may be more or less sensitive than those found in the Anacostia River.

## 6.3 Uncertainties Associated with the Wildlife Community Evaluation

There are several sources of uncertainty in the evaluation of wildlife risks that may over- or under-estimate risks. Most of the assumptions for this BERA (i.e., 100% bioavailability, 100% fish diet, AUF of 1, ED of 1) are conservative and in combination likely to over-estimate risks. For example, it is unlikely that all three receptors would acquire 100% of their food from the Waterside Investigation Area.

The species evaluated in the food chain model were selected to represent species that may be present within the Waterside Investigation Area. Site-specific information was not available for these receptors (e.g., body weights, dietary composition), so assumptions were made in the model that an average body weight was protective of the average receptor, but may not be protective of sensitive receptors.

Consistent with the Preliminary BERA, the sediment data set represents surface sediments collected throughout the Waterside Investigation Area. The heron and raccoon forage from the shoreline, so they are unlikely to be exposed to sediment in deeper water. In general, PCB concentrations are highest in the Cove, although some elevated concentrations are present in the channel as well. Sediment ingestion for the three representative species contributes less than 5% of the TDD, so an increase in the sediment concentration is unlikely to impact the HQs.

As detailed in Section 6.1.8, there is some uncertainty associated with the use of PCB Aroclor versus PCB congener data. Based on a comparison of 31 surface sediment samples that were analyzed for both Aroclors and congeners, the ratio of total PCB congener to total PCB Aroclor ranged from less than 1 to 6.2 (**Table 6-2**), with an average of 2.2 and median of 2.0. However, the HQs calculated or total PCB congeners for birds and mammals in the food chain model are below 1 (**Table 4-15**). Therefore, this uncertainty does not result in significant changes in the BERA wildlife risk characterization, and no indication of bird or mammal risks was found in this BERA.

As detailed in Section 2.5.1 and Section 2.5.2, the DOEE whole body fish tissue and invertebrate tissue samples identified as dietary items provided measures of tissue residue concentrations. However, the DOEE fish and invertebrate tissue samples were not collected for the purposes of this BERA, and in addition, no fish tissue samples and only six invertebrate tissue samples were collected in the Waterside Investigation Area. In addition, it was assumed that the forage and mid-level trophic fish included as prey items were of appropriate size for consumption by the belted kingfisher and great blue heron; however, fish length data were not available to confirm this assumption. As a result, the representativeness of the COPC concentrations detected in the fish and invertebrate tissue samples to the Waterside Investigation Area is uncertain.

The wildlife TRVs considered were based on NOAELs, which represent a level where no effect has been observed and therefore are very conservative estimates of the exposure level that could potentially result in adverse effects to wildlife receptors. LOAEL-based TRVs were also considered alongside NOAEL-based TRVs. Since LOAEL-based TRVs represent potential exposure levels at which adverse effects may become evident, they are more intrinsically related to potential for adverse effects in the field. **Attachment H** provides more details regarding the selected TRVs.

# 7 Summary and Conclusions

A BERA was conducted to evaluate the potential for risks to ecological receptors posed by COPCs in sediment in the Waterside Investigation Area of the Anacostia River.

Based on the available data, the ecological exposure pathways evaluated in the BERA include:

- Direct contact with sediment and pore water by benthic macroinvertebrates;
- Ingestion of contaminated food sources by warmwater fish; and
- Ingestion of contaminated prey items (i.e., fish) and abiotic media (i.e., sediment) by selected vertebrate wildlife receptors (i.e., piscivorous birds and mammals).

The evaluation of the potential for risks to the benthic community due to Study Area-related COPCs considered six lines of evidence: (1) sediment benchmark screening, (2) evaluation of divalent metals bioavailability using SEM, AVS, and TOC data, (3) evaluation of PAH bioavailability, (4) laboratory toxicity testing, (5) benthic macroinvertebrate community survey, and (6) pore water screening. These lines of evidence are summarized below.

Concentrations of several constituents (e.g., total PCBs, metals, and pesticides) in surficial sediment exceeded literature-derived benthic macroinvertebrate screening values in both the Waterside Investigation Area and the background area reaches of the Anacostia River evaluated in this BERA. The concentrations of several compounds (e.g., total PCBs) were elevated in the Cove relative to elsewhere in the Waterside Investigation Area. However, the ranges of concentrations for most COPCs were similar to the ranges detected in background samples and to background threshold values. In addition, evaluation of bioavailability of divalent metals (cadmium, copper, lead, nickel, cadmium, and zinc) and PAHs (34 constituents) demonstrated that these constituents are not bioavailable in surficial sediment and therefore are not stressors of concern, with the possible exception of PAHs at one sampling station (SED7B).

Surficial sediment pore water results indicated that constituents were not present in pore water at concentrations greater than conservative screening benchmarks, with only a few exceptions (barium, iron, and manganese), and further that concentrations of pore water constituents in the Waterside Investigation Area and the background area were similar. PCBs were not present in pore water at concentrations indicative of ecological risk.

In general, amphipod and midge survival responses were similar among the five upstream background samples and the 15 Waterside Investigation Area samples. Only one sample (SED7B, located in the channel) had reduced amphipod survival relative to two upstream background samples. There were no differences between Waterside Investigation Area and background samples for midge survival. Reduced amphipod growth was observed in Site sample SED7B relative to three background samples. Two site samples, SED7B (collected in the channel) and SED7.5E (collected in the Cove), had reduced growth responses for amphipods and/or chironomids relative to most or all background sample responses.

The benthic community survey results, which provide a Site-specific, field-based metric of community health, generally demonstrated no impacts associated with exposure to COPCs in the Waterside Investigation Area. In fact, the majority of benthic samples collected from the Waterside Investigation Area was more diverse and had higher bioassessment scores than those samples collected from the background area.

The results of the sediment toxicity tests and co-located results for analytical, physical, and community survey sampling were evaluated on a sample-by-sample basis and across the data set to determine if any spatial trends are apparent among the parameters measured. For three of four toxicity endpoints (survival of both amphipods and midges, and amphipod growth), no significant trends between chemistry, physical characteristics, and toxicity were observed among Waterside Investigation Area and background locations. Midge growth was significantly and negatively correlated to percent fines, total PCB PEC-Qs, and PAH ∑ESBTUs in sediment and pore water. However, the total PCB and PAH correlations are not toxicologically relevant because all but one sample contained PCBs at concentrations below the PEC (i.e., total PCB PEC-Q less than 1) and PAH ∑ESBTUs (i.e., ∑ESBTUs less than 1). It is possible that the correlation with grain size is more meaningful than the COPCs, as fine-grained sediment controls distribution of hydrophobic organic compounds and can exert direct effects on invertebrates.

Three lines of evidence were used to evaluate the assessment endpoint developed for the fish community: surface water benchmark screening, groundwater benchmark screening, and comparison of fish tissue concentrations to NOEC and LOEC CBRs. Screening of surface water or groundwater against conservative benchmarks did not indicate that there were risks from direct contact. Maximum and average fish tissue EPCs fell below the maximum NOEC and LOEC CBRs for all COPCs. Comparisons of fish tissue samples collected upstream and downstream of the tissue samples selected to represent Waterside Investigation Area conditions indicate similar concentrations among Waterside Investigation Area, downstream, and upstream fish tissue samples for all COPCs.

Potential for risks to wildlife were evaluated through modeled dietary exposures, which indicated that all HQs for the belted kingfisher, great blue heron, and raccoon were well below or equal to 1 for the most conservative exposure scenarios (i.e., considering maximum EPCs and NOAEL- and LOAEL-based TRVs). Based on these results, risks to birds and mammals through food chain exposure to COPCs in the Waterside Investigation Area are not expected.

A WOE approach was used to synthesize conclusions regarding overall potential risks to ecological receptors by considering the results of all components of the assessment methodology (i.e., the approach was designed to integrate the results of physical, biological, toxicological, and field measurement endpoints to draw risk-based conclusions). The WOE components were designed to provide relative measures of potential risks for different ecological receptors and exposure pathways. The WOE data analysis approach employed in the BERA used both qualitative and semi-quantitative protocols to evaluate and interpret the results from the measurement endpoints for the Waterside Investigation Area and the background areas. Individual measurement endpoint results were evaluated to determine whether or not they support a finding of no significant risk for each assessment endpoint.

The matrix presented in **Table 7-1** was used to characterize and summarize the different lines of evidence evaluated in this BERA. This matrix includes six benthic macroinvertebrate measurement endpoints, one warmwater fish measurement endpoint, and one vertebrate wildlife measurement endpoint. The potential for risks were evaluated in four discrete categories, with decision rules identified for each category: (1) High potential for ecological risk; (2) Low potential for ecological risk; (3) Indeterminate potential for ecological risk; and (4) No potential for ecological risk. Decision rules for each of these categories are presented below. The results of the WOE are presented in **Table 7-1**.

| Risk Category | Decision Rules |
|---|---|
| None | – NOAEL HQ < 2<br>– Low magnitude (PEC-Q < 2) of PEC exceedances<br>– Low/no COPC bioavailability<br>– Conditions are similar to background |
| Indeterminate | See risk classification rationale for explanation |
| Low | – NOAEL HQ ≤ 2, LOAEL HQ < 10<br>– Moderate magnitude (2 > PEC-Q < 10) of PEC exceedances<br>– Low/no COPC bioavailability<br>– Weak association between COPC concentration and response<br>– Conditions are different from background |
| High | – LOAEL HQ > 10<br>– Large magnitude (PEC-Q = 10) of PEC exceedances<br>– Evidence of COPC bioavailability<br>– Strong association between COPC concentration and response<br>– Conditions are different from background |

Based on the WOE (**Table 7-1**), the following general conclusions can be made regarding the overall potential for risk.

1. No receptors evaluated in this BERA exhibit a high potential for ecological risk. The majority of the risk assessment endpoints evaluated in this BERA fell within the lower portion of the matrices ("Indeterminate" to "No Potential for Ecological Risks").
2. For the most part, the potential for ecological risk in the Waterside Investigation Area is no greater than the potential for risk in the background areas.
3. For the benthic macroinvertebrate community, the BERA analysis indicates a lack of constituent bioavailability in surficial sediments. The results of the WOE for the benthic community also suggest that any incremental risks contributed by the Benning Road facility are largely indistinguishable from the anthropogenic, urban background conditions that characterize the Anacostia River. In several of the comparisons considered in the WOE evaluation (e.g. macroinvertebrate community study), the potential for ecological risks in the upstream background area is actually slightly higher than the potential for ecological risks in the Waterside Investigation Area.
4. No potential for risk was identified for fish. Fish tissue concentrations of all COPCs fall well below the majority of CBR thresholds evaluated in this BERA. This finding is consistent with the

fish tissue CBR evaluation presented in the ARSP RI (Tetra Tech, 2018). In addition, comparison of tissue residues from fish collected upstream and downstream of the samples selected to represent Study Area conditions are all similar to one another, suggesting no substantive differences between Waterside Investigation Area fish tissue residues and the remainder of the Anacostia River.

5. No potential for risk was identified for raccoons, great blue herons, or kingfishers. HQs for these receptors were well below or equal to 1 for all conservative exposure scenarios evaluated in the BERA, which considered maximum EPCs and NOAEL- and LOAEL-based TRVs. These results are consistent with the wildlife risk evaluation in the ARSP RI (Tetra Tech, 2018).

The results of this BERA indicate that: (1) there are elevated levels of several constituents present in Anacostia River surficial sediment in the Waterside Investigation Area and the upstream background locations; (2) concentrations of several compounds (e.g., PCBs) were elevated in the Cove relative to elsewhere in the Waterside Investigation Area; however, the majority of compounds are present at concentrations consistent with upstream background conditions; (3) there is no potential for risk to fish, birds, or mammals from exposure to COPCs in the Waterside Investigation Area; and (4) the potential for ecological risk to benthic invertebrates is low to indeterminate.

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# Tables

**Table 2-1**
**Sediment Samples**

| Source | Sample Identification | Sample Date | Depth (ft) | X Coordinate | Y Coordinate |
|---|---|---|---|---|---|
| Pepco | SED1.5B00N | 11/6/2013 | 0 - 0.5 | 1323208.9 | 447688.22 |
| Pepco | SED1.5C00AN | 6/21/2017 | 0 - 0.33 | 1323331.98 | 447788.51 |
| Pepco | SED10A00N | 11/11/2013 | 0 - 0.5 | 1323959.18 | 450826.25 |
| Pepco | SED10B00N | 11/11/2013 | 0 - 0.5 | 1324041.53 | 450790.5 |
| Pepco | SED10C00N | 11/11/2013 | 0 - 0.5 | 1324112.83 | 450738.1 |
| Pepco | SED1A00N | 11/6/2013 | 0 - 0.5 | 1322949.33 | 447487.01 |
| Pepco | SED1B00N | 11/6/2013 | 0 - 0.5 | 1323022.01 | 447478.73 |
| Pepco | SED1C00N | 11/7/2013 | 0 - 0.5 | 1323207.62 | 447452.22 |
| Pepco | SED2.5B00N | 11/7/2013 | 0 - 0.5 | 1323217.1 | 448285.96 |
| Pepco | SED2A00N | 11/6/2013 | 0 - 0.5 | 1323069.35 | 447930.53 |
| Pepco | SED2B00N | 11/5/2013 | 0 - 0.5 | 1323120 | 447932.7 |
| Pepco | SED2C00N | 11/6/2013 | 0 - 0.5 | 1323344.64 | 447937.51 |
| Pepco | SED3.5B00N | 11/12/2013 | 0 - 0.5 | 1323056.8 | 448558.14 |
| Pepco | SED3A00N | 11/7/2013 | 0 - 0.5 | 1323010.07 | 448455.78 |
| Pepco | SED3B00N | 11/8/2013 | 0 - 0.5 | 1323062.88 | 448464.11 |
| Pepco | SED3C00N | 11/7/2013 | 0 - 0.5 | 1323124.13 | 448467.71 |
| Pepco | SED4.5B00N | 11/8/2013 | 0 - 0.5 | 1323163.53 | 449128.77 |
| Pepco | SED4A00N | 11/12/2013 | 0 - 0.5 | 1322976.43 | 448917.18 |
| Pepco | SED4B00N | 11/12/2013 | 0 - 0.5 | 1323088.7 | 448900.28 |
| Pepco | SED4C00N | 11/12/2013 | 0 - 0.5 | 1323146.06 | 448888.08 |
| Pepco | SED5.5B00N | 11/12/2013 | 0 - 0.5 | 1323400.33 | 449512.52 |
| Pepco | SED5A00N | 11/8/2013 | 0 - 0.5 | 1323198.27 | 449411.76 |
| Pepco | SED5B00AN | 6/20/2017 | 0 - 0.33 | 1323266.69 | 449349.09 |
| Pepco | SED5B00N | 11/8/2013 | 0 - 0.5 | 1323266.69 | 449349.09 |
| Pepco | SED5C00N | 11/11/2013 | 0 - 0.5 | 1323337.14 | 449338.07 |
| Pepco | SED6.5D00EN | 6/9/2017 | 0 - 0.33 | 1323798.17 | 449651.75 |
| Pepco | SED6.5D00N | 11/25/2013 | 0 - 0.5 | 1323798.17 | 449651.75 |
| Pepco | SED6.5E00EN | 6/8/2017 | 0 - 0.33 | 1323969.79 | 449649.36 |
| Pepco | SED6.5E00N | 11/25/2013 | 0 - 0.5 | 1323969.79 | 449649.36 |
| Pepco | SED6A00EN | 6/8/2017 | 0 - 0.33 | 1323401.29 | 449707.18 |
| Pepco | SED6A00N | 11/13/2013 | 0 - 0.5 | 1323401.29 | 449707.18 |
| Pepco | SED6B00EN | 6/8/2017 | 0 - 0.33 | 1323424.78 | 449687.44 |
| Pepco | SED6B00N | 11/13/2013 | 0 - 0.5 | 1323424.78 | 449687.44 |
| Pepco | SED6C00EN | 6/7/2017 | 0 - 0.33 | 1323525.05 | 449590.24 |
| Pepco | SED6C00N | 11/14/2013 | 0 - 0.5 | 1323525.05 | 449590.24 |
| Pepco | SED7.5D00EN | 6/9/2017 | 0 - 0.33 | 1323906.87 | 449865.94 |
| Pepco | SED7.5D00N | 11/25/2013 | 0 - 0.5 | 1323906.87 | 449865.94 |
| Pepco | SED7.5E00EN | 6/8/2017 | 0 - 0.33 | 1324043.58 | 449782.68 |
| Pepco | SED7.5E00N | 11/25/2013 | 0 - 0.5 | 1324043.58 | 449782.68 |
| Pepco | SED7A00EN | 6/9/2017 | 0 - 0.33 | 1323526.84 | 449965.98 |
| Pepco | SED7A00N | 11/13/2013 | 0 - 0.5 | 1323526.84 | 449965.98 |
| Pepco | SED7B00EN | 6/7/2017 | 0 - 0.33 | 1323647.81 | 449847.44 |
| Pepco | SED7B00N | 11/13/2013 | 0 - 0.5 | 1323647.81 | 449847.44 |
| Pepco | SED7D00EN | 6/9/2017 | 0 - 0.33 | 1323814.32 | 449789.58 |
| Pepco | SED7D00N | 11/25/2013 | 0 - 0.5 | 1323814.32 | 449789.58 |
| Pepco | SED7E00EN | 6/8/2017 | 0 - 0.33 | 1323942.71 | 449728.24 |
| Pepco | SED7E00N | 11/25/2013 | 0 - 0.5 | 1323942.71 | 449728.24 |
| Pepco | SED7F00EN | 6/8/2017 | 0 - 0.33 | 1324119.87 | 449660.56 |
| Pepco | SED7F00N | 11/25/2013 | 0 - 0.5 | 1324119.87 | 449660.56 |
| Pepco | SED7G00N | 1/30/2014 | 0 - 0.5 | 1324216.84 | 449619.14 |
| Pepco | SED8.5B00N | 11/13/2013 | 0 - 0.5 | 1323863.72 | 450263.69 |
| Pepco | SED8A00EN | 6/9/2017 | 0 - 0.33 | 1323627.03 | 450167.52 |
| Pepco | SED8A00N | 11/13/2013 | 0 - 0.5 | 1323627.03 | 450167.52 |
| Pepco | SED8B00EN | 6/9/2017 | 0 - 0.33 | 1323699.75 | 450124.44 |
| Pepco | SED8B00N | 11/13/2013 | 0 - 0.5 | 1323699.75 | 450124.44 |
| Pepco | SED8C00EN | 6/7/2017 | 0 - 0.33 | 1323810.54 | 450062.6 |
| Pepco | SED8C00N | 11/14/2013 | 0 - 0.5 | 1323810.54 | 450062.6 |
| Pepco | SED9.5B00N | 11/11/2013 | 0 - 0.5 | 1324031.21 | 450586.65 |
| Pepco | SED9A00N | 11/11/2013 | 0 - 0.5 | 1323815.06 | 450506.8 |
| Pepco | SED9B00N | 11/11/2013 | 0 - 0.5 | 1323894.15 | 450467.75 |
| Pepco | SED9C00N | 11/11/2013 | 0 - 0.5 | 1323961.98 | 450423.72 |
| Pepco | WSED100N | 11/15/2013 | 0 - 0.5 | 1323146.52 | 448403.78 |
| Pepco | WSED200N | 11/15/2013 | 0 - 0.5 | 1323124.83 | 448582.42 |
| DOEE | RI-R6-18-SS | 4/30/2015 | 0 - 0.5 | 1323351.05 | 448288.54 |
| DOEE | RI-R6-21-SS | 4/29/2015 | 0 - 0.5 | 1323865.35 | 449673.19 |
| DOEE | RI-R6-22-SS | 4/30/2015 | 0 - 0.5 | 1323957.97 | 450287.93 |
| DOEE | RI-R6-23-SS | 4/30/2015 | 0 - 0.5 | 1324085.34 | 450581.99 |
| DOEE | P2-R6-30-SS | 6/9/2016 | 0 - 0.5 | 1323315.11 | 448284.5801 |
| DOEE | P2-R6-31-SS | 6/28/2016 | 0 - 0.5 | 1323336.69 | 448306.6601 |
| DOEE | P2-R6-32-SS | 6/28/2016 | 0 - 0.5 | 1323865.22 | 449699.8 |
| DOEE | P2-R6-33-SS | 6/28/2016 | 0 - 0.5 | 1324081.25 | 450648.5901 |
| DOEE | RI-R5-03-SS | 7/25/2014 | 0 - 0.5 | 1323218.45 | 447545.5199 |
| DOEE | RI-R5-04-SS | 7/28/2014 | 0 - 0.5 | 1323102.02 | 447551.77 |
| DOEE | RI-R5-05-SS | 7/30/2014 | 0 - 0.5 | 1323277.25 | 447660.0199 |
| DOEE | RI-R5-06-SS | 4/30/2015 | 0 - 0.5 | 1323230.65 | 447806.02 |

**Table 2-1**
**Sediment Samples**

| Source | Sample Identification | Sample Date | Depth (ft) | X Coordinate | Y Coordinate |
|---|---|---|---|---|---|
| DOEE | P2-R5-08-SS | 6/9/2016 | 0 - 0.5 | 1323150.9 | 447519.7601 |
| DOEE | P2-R5-09-SS | 6/28/2016 | 0 - 0.5 | 1323366.33 | 447725.9601 |
| DOEE | RI-R6-01-SS | 8/5/2014 | 0 - 0.5 | 1323191.16 | 448311.6601 |
| DOEE | RI-R6-02-SS | 7/28/2014 | 0 - 0.5 | 1323139.94 | 448482.4499 |
| DOEE | RI-R6-03-SS | 7/28/2014 | 0 - 0.5 | 1323359.47 | 449507.14 |
| DOEE | RI-R6-04-SS | 7/28/2014 | 0 - 0.5 | 1323513.96 | 449559.4099 |
| DOEE | RI-R6-05-SS | 8/4/2014 | 0 - 0.5 | 1324050.55 | 449659.7201 |
| DOEE | RI-R6-06-SS | 8/4/2014 | 0 - 0.5 | 1324037.92 | 450489.9499 |
| DOEE | RI-R6-07-SS | 7/30/2014 | 0 - 0.5 | 1323810.62 | 450489.5799 |

Notes:
ft - Feet.
The DOEE sediment samples were collected by Tetra Tech on behalf of DOEE for the ARSP (DOEE, 2018).

## Table 2-2
## Pore Water Samples

| Source | Area | Sample Identification | Sample Date | X Coordinate | Y Coordinate |
|---|---|---|---|---|---|
| Pepco | Site | PW6.5D00EN | 6/9/2017 | 1323798.17 | 449651.75 |
| Pepco | Site | PW6.5E00EN | 6/8/2017 | 1323969.79 | 449649.36 |
| Pepco | Site | PW6A00EN | 6/8/2017 | 1323401.29 | 449707.18 |
| Pepco | Site | PW6B00EN | 6/8/2017 | 1323424.78 | 449687.44 |
| Pepco | Site | PW6C00EN | 6/7/2017 | 1323525.05 | 449590.24 |
| Pepco | Site | PW7.5D00EN | 6/9/2017 | 1323906.87 | 449865.94 |
| Pepco | Site | PW7.5E00EN | 6/8/2017 | 1324043.58 | 449782.68 |
| Pepco | Site | PW7A00EN | 6/9/2017 | 1323526.84 | 449965.98 |
| Pepco | Site | PW7B00EN | 6/7/2017 | 1323647.81 | 449847.44 |
| Pepco | Site | PW7D00EN | 6/9/2017 | 1323814.32 | 449789.58 |
| Pepco | Site | PW7E00EN | 6/8/2017 | 1323942.71 | 449728.24 |
| Pepco | Site | PW7F00EN | 6/8/2017 | 1324119.87 | 449660.56 |
| Pepco | Site | PW8A00EN | 6/9/2017 | 1323627.03 | 450167.52 |
| Pepco | Site | PW8B00EN | 6/9/2017 | 1323699.75 | 450124.44 |
| Pepco | Site | PW8C00EN | 6/7/2017 | 1323810.54 | 450062.6 |

Note: Sediment for pore water analysis was collected using the same grab sampling techniques for bulk sediment chemistry from the BAZ interval (surficial 10 cm).

**Table 2-3**
**Fish Tissue Samples**

| Source | Area (a) | Sample Identification | Species | Sample Date | X Coordinate | Y Coordinate |
|---|---|---|---|---|---|---|
| DOEE | EU3 | RI-R4-FT-17-GF | STS, ESM, WP, PKS | 12/30/2014 | 1322409.5 | 444121.5 |
| DOEE | EU3 | RI-R4-FT-17-GM | BG | 1/15/2015 | 1322409.5 | 444121.5 |
| DOEE | EU3 | RI-R4-FT-17-GT | BC | 1/25/2015 | 1322409.5 | 444121.5 |
| DOEE | EU3 | RI-R5-FT-19-GF | STS | 12/30/2014 | 1322699.6 | 445589.4 |
| DOEE | EU3 | RI-R5-FT-19-GM | PKS | 1/7/2015 | 1322699.6 | 445589.4 |
| DOEE | EU3 | RI-R5-FT-19-GT | LMB | 1/15/2015 | 1322699.6 | 445589.4 |
| DOEE | EU3 | RI-R5-FT-22-GF | ESM, STS | 1/19/2015 | 1322995.4 | 446761.4 |
| DOEE | EU3 | RI-R5-FT-22-GM | BG, PKS | 1/15/2015 | 1322995.4 | 446761.4 |
| DOEE | EU3 | RI-R5-FT-22-GT | LMB | 1/14/2015 | 1322995.4 | 446761.4 |
| DOEE | EU3 | RI-R6-FT-28-GF | STS, BKF, GS, ESM, PKS, BG, RSF | 12/29/2014 | 1325408.2 | 453913.0 |
| DOEE | EU3 | RI-R6-FT-28-GM | BG | 1/20/2015 | 1325408.2 | 453913.0 |
| DOEE | EU3 | RI-R6-FT-28-GT | LMB | 1/13/2015 | 1325408.2 | 453913.0 |
| DOEE | EU3 | RI-R6-FT-29-GF | STS, BKF, ESM | 1/20/2015 | 1326248.7 | 454536.5 |
| DOEE | EU3 | RI-R6-FT-29-GM | BG | 1/8/2015 | 1326248.7 | 454536.5 |
| DOEE | EU3 | RI-R6-FT-29-GT | LMB | 1/14/2015 | 1326248.7 | 454536.5 |
| DOEE | EU3 | RI-R6-FT-30-GF | ESM, STS | 12/29/2014 | 1326347.9 | 454123.2 |
| DOEE | EU3 | RI-R6-FT-30-GM | PKS | 1/7/2015 | 1326347.9 | 454123.2 |
| DOEE | EU3 | RI-R6-FT-30-GT | LMB | 1/23/2015 | 1326347.9 | 454123.2 |
| DOEE | KL | RI-KL-FT-16-GF | STS | 12/30/2014 | 1320983.4 | 443723.3 |
| DOEE | KL | RI-KL-FT-16-GM | PKS | 1/15/2015 | 1320983.4 | 443723.3 |
| DOEE | KL | RI-KL-FT-16-GT | LMB | 1/14/2015 | 1320983.4 | 443723.3 |
| DOEE | KL | RI-KL-FT-18-GF | ESM, PKS, STS, CCS | 12/30/2014 | 1322132.6 | 445637.5 |
| DOEE | KL | RI-KL-FT-18-GM | BG | 1/19/2015 | 1322132.6 | 445637.5 |
| DOEE | KL | RI-KL-FT-18-GT | LMB | 1/19/2015 | 1322132.6 | 445637.5 |
| DOEE | KL | RI-KL-FT-20-GF | BKF, STS, ESM, PKS | 1/20/2015 | 1321590.3 | 446817.5 |
| DOEE | KL | RI-KL-FT-20-GM | PKS, BG | 1/8/2015 | 1321590.3 | 446817.5 |
| DOEE | KL | RI-KL-FT-20-GT | LMB | 1/23/2015 | 1321590.3 | 446817.5 |
| DOEE | KL | RI-KL-FT-21-GF | GS, ESM, STS, PKS | 12/29/2014 | 1322217.3 | 446970.4 |
| DOEE | KL | RI-KL-FT-21-GM | PKS | 12/30/2014 | 1322217.3 | 446970.4 |
| DOEE | KL | RI-KL-FT-21-GT | LMB | 1/13/2015 | 1322217.3 | 446970.4 |
| DOEE | KL | RI-KL-FT-23-GF | STS, ESM | 1/15/2015 | 1322038.7 | 448853.3 |
| DOEE | KL | RI-KL-FT-23-GM | PKS | 1/7/2015 | 1322038.7 | 448853.3 |
| DOEE | KL | RI-KL-FT-24-GF | STS, ESM | 1/20/2015 | 1322451.2 | 449831.1 |
| DOEE | KL | RI-KL-FT-24-GM | PKS | 1/19/2015 | 1322451.2 | 449831.1 |
| DOEE | KL | RI-KL-FT-24-GT | LMB | 1/19/2015 | 1322451.2 | 449831.1 |
| DOEE | KL | RI-KL-FT-25-GF | ESM, GS, STS | 12/29/2014 | 1323249.1 | 450804.8 |
| DOEE | KL | RI-KL-FT-25-GM | PKS, BG | 1/12/2015 | 1323249.1 | 450804.8 |
| DOEE | KL | RI-KL-FT-25-GT | LMB | 1/23/2015 | 1323249.1 | 450804.8 |
| DOEE | KL | RI-KL-FT-26-GF | ESM | 1/5/2015 | 1323203.4 | 451713.1 |
| DOEE | KL | RI-KL-FT-27-GF | ESM | 1/23/2015 | 1324121.1 | 451881.1 |
| DOEE | KL | RI-KL-FT-27-GM | PKS | 1/25/2015 | 1324121.1 | 451881.1 |
| DOEE | KL | RI-KL-FT-27-GT | LMB | 1/13/2015 | 1324121.1 | 451881.1 |
| DOEE | Upstream | RI-R6-FT-31-GF | ESM | 12/29/2014 | 1328440.2 | 455288.3 |
| DOEE | Upstream | RI-R6-FT-31-GM | BG, RSF | 1/8/2015 | 1328440.2 | 455288.3 |
| DOEE | Upstream | RI-R6-FT-31-GT | LMB | 1/8/2015 | 1328440.2 | 455288.3 |
| DOEE | Upstream | RI-R7-FT-32-GF | ESM | 12/29/2014 | 1328510.0 | 455662.2 |
| DOEE | Upstream | RI-R7-FT-32-GM | BG | 1/15/2015 | 1328510.0 | 455662.2 |
| DOEE | Upstream | RI-R7-FT-32-GT | SH | 1/20/2015 | 1328510.0 | 455662.2 |
| DOEE | Upstream | RI-R7-FT-33-GF | ESM | 12/22/2014 | 1329621.9 | 457087.9 |
| DOEE | Upstream | RI-R7-FT-33-GM | BG | 1/12/2015 | 1329621.9 | 457087.9 |
| DOEE | Upstream | RI-R7-FT-33-GT | LMB | 1/7/2015 | 1329621.9 | 457087.9 |
| DOEE | Upstream | RI-R7-FT-34-GF | GS, STS, ESM | 12/22/2014 | 1329863.6 | 458281.9 |
| DOEE | Upstream | RI-R7-FT-34-GM | BG | 1/8/2015 | 1329863.6 | 458281.9 |
| DOEE | Upstream | RI-R7-FT-34-GT | LMB | 1/13/2015 | 1329863.6 | 458281.9 |
| DOEE | Upstream | RI-R7-FT-35-GF | GS, MMC, STS, BKF, PKS, BG | 12/22/2014 | 1329794.3 | 458988.4 |
| DOEE | Upstream | RI-R7-FT-35-GM | BG | 1/7/2015 | 1329794.3 | 458988.4 |
| DOEE | Upstream | RI-R7-FT-35-GT | LMB | 1/14/2015 | 1329794.3 | 458988.4 |
| DOEE | Upstream | RI-R7-FT-36-GF | EMF, RSF, BG, PKS, STS | 12/22/2014 | 1329544.8 | 460143.9 |
| DOEE | Upstream | RI-R7-FT-36-GM | BG | 1/12/2015 | 1329544.8 | 460143.9 |
| DOEE | Upstream | RI-R7-FT-36-GT | LMB | 1/23/2015 | 1329544.8 | 460143.9 |
| DOEE | Upstream | RI-R7-FT-37-GF | PKS, BG, MMC, STS, ESM | 12/22/2014 | 1329816.9 | 461305.6 |
| DOEE | Upstream | RI-R7-FT-37-GM | PKS, BG, RSF | 1/8/2015 | 1329816.9 | 461305.6 |
| DOEE | Upstream | RI-R7-FT-37-GT | SMB | 1/7/2015 | 1329816.9 | 461305.6 |
| DOEE | Upstream | RI-R7-FT-38-GF | ESM, BKF | 12/22/2014 | 1329784.1 | 461578.7 |
| DOEE | Upstream | RI-R7-FT-38-GM | PKS, BG | 1/8/2015 | 1329784.1 | 461578.7 |
| DOEE | Upstream | RI-R7-FT-38-GT | LMB | 1/13/2015 | 1329784.1 | 461578.7 |
| DOEE | Upstream | RI-R7-FT-39-GF | BKF, MMC, BNM, PKS, QB | 1/8/2015 | 1329743.2 | 461716.9 |

**Table 2-3**
**Fish Tissue Samples**

| Source | Area (a) | Sample Identification | Species | Sample Date | X Coordinate | Y Coordinate |
|---|---|---|---|---|---|---|
| DOEE | Upstream | RI-R7-FT-39-GM | PKS, BG | 1/7/2015 | 1329743.2 | 461716.9 |
| DOEE | Upstream | RI-R7-FT-39-GT | LMB | 1/19/2015 | 1329743.2 | 461716.9 |
| DOEE | Upstream | RI-R7-FT-40-GF | PKS, EMF, MMC, MMC, BKF | 12/22/2014 | 1329253.3 | 462521.7 |
| DOEE | Upstream | RI-R7-FT-40-GM | PKS | 1/19/2015 | 1329253.3 | 462521.7 |
| DOEE | Upstream | RI-R7-FT-40-GT | LMB | 1/23/2015 | 1329253.3 | 462521.7 |
| DOEE | Upstream | RI-R7-FT-41-GF | BKF, MMC | 12/22/2014 | 1329280.3 | 462778.2 |
| DOEE | Upstream | RI-R7-FT-41-GM | PKS | 1/8/2015 | 1329280.3 | 462778.2 |
| DOEE | Upstream | RI-R7-FT-41-GT | LMB | 1/8/2015 | 1329280.3 | 462778.2 |
| DOEE | Upstream | RI-R7-FT-42-GF | ESM, BKF, PKS, TD, MMC, STS | 12/22/2014 | 1328617.5 | 463220.3 |
| DOEE | Upstream | RI-R7-FT-42-GM | PKS | 1/12/2015 | 1328617.5 | 463220.3 |
| DOEE | Upstream | RI-R7-FT-42-GT | LMB | 1/14/2015 | 1328617.5 | 463220.3 |
| DOEE | Upstream | RI-R7-FT-43-GF | STS, BKF, ESM, MMC | 12/22/2014 | 1328075.7 | 463842.8 |
| DOEE | Upstream | RI-R7-FT-43-GM | RSF | 1/12/2015 | 1328075.7 | 463842.8 |
| DOEE | Upstream | RI-R7-FT-43-GT | LMB | 1/6/2015 | 1328075.7 | 463842.8 |
| DOEE | Upstream | RI-R7-FT-44-GF | BKF, MMC, TD, GSF, BG | 12/22/2014 | 1328155.4 | 464340.4 |
| DOEE | Upstream | RI-R7-FT-44-GM | PKS | 1/8/2015 | 1328155.4 | 464340.4 |
| DOEE | Upstream | RI-R7-FT-44-GT | LMB | 1/6/2015 | 1328155.4 | 464340.4 |
| DOEE | Upstream | RI-R7-FT-45-GF | GSF, RSF, PKS, BG | 12/22/2014 | 1327932.8 | 465251.1 |
| DOEE | Upstream | RI-R7-FT-45-GM | RSF | 1/15/2015 | 1327932.8 | 465251.1 |
| DOEE | Upstream | RI-R7-FT-45-GT | LMB | 1/15/2015 | 1327932.8 | 465251.1 |
| DOEE | Upstream | RI-R7-FT-46-GF | MMC | 12/22/2014 | 1328778.8 | 465398.4 |
| DOEE | Upstream | RI-R7-FT-46-GM | RSF | 1/12/2015 | 1328778.8 | 465398.4 |
| DOEE | Upstream | RI-R7-FT-46-GT | LMB | 12/30/2014 | 1328778.8 | 465398.4 |
| DOEE | Downstream | RI-R1-FT-07-GF | STS, GSF, BG, BKF | 1/19/2015 | 1308961.0 | 434653.5 |
| DOEE | Downstream | RI-R1-FT-07-GM | YP | 1/20/2015 | 1308961.0 | 434653.5 |
| DOEE | Downstream | RI-R1-FT-07-GT | LMB | 1/26/2015 | 1308961.0 | 434653.5 |
| DOEE | Downstream | RI-R1-FT-08-GF | BKF, TD, STS, ESM, ISS | 1/5/2015 | 1308965.1 | 435883.7 |
| DOEE | Downstream | RI-R1-FT-08-GM | YP | 1/15/2015 | 1308965.1 | 435883.7 |
| DOEE | Downstream | RI-R1-FT-08-GT | LMB | 1/15/2015 | 1308965.1 | 435883.7 |
| DOEE | Downstream | RI-R1-FT-09-GF | STS | 1/5/2015 | 1310223.9 | 437751.3 |
| DOEE | Downstream | RI-R1-FT-09-GM | YP | 1/5/2015 | 1310223.9 | 437751.3 |
| DOEE | Downstream | RI-R1-FT-09-GT | LMB | 1/14/2015 | 1310223.9 | 437751.3 |
| DOEE | Downstream | RI-R1-FT-10-GF | RSF, GSF, ESM, PKS, BKF, STS | 1/5/2015 | 1311092.2 | 437267.2 |
| DOEE | Downstream | RI-R1-FT-10-GM | YP | 1/5/2015 | 1311092.2 | 437267.2 |
| DOEE | Downstream | RI-R1-FT-10-GT | LMB | 1/23/2015 | 1311092.2 | 437267.2 |
| DOEE | Downstream | RI-R3-FT-11-GF | GS, STS, LMB, PKS, WP | 1/5/2015 | 1317293.8 | 440607.7 |
| DOEE | Downstream | RI-R3-FT-11-GM-A | YP | 1/5/2015 | 1317293.8 | 440607.7 |
| DOEE | Downstream | RI-R3-FT-11-GM-B | BG | 1/8/2015 | 1317293.8 | 440607.7 |
| DOEE | Downstream | RI-R3-FT-11-GT | LMB | 1/13/2015 | 1317293.8 | 440607.7 |
| DOEE | Downstream | RI-R3-FT-12-GF | STS, PKS, BKF | 12/30/2014 | 1318810.8 | 440473.6 |
| DOEE | Downstream | RI-R3-FT-12-GM | BG | 1/7/2015 | 1318810.8 | 440473.6 |
| DOEE | Downstream | RI-R3-FT-12-GT | SB | 1/13/2015 | 1318810.8 | 440473.6 |
| DOEE | Downstream | RI-R3-FT-13-GF | STS, GS | 1/5/2015 | 1319607.7 | 441397.8 |
| DOEE | Downstream | RI-R3-FT-13-GM | PKS | 1/7/2015 | 1319607.7 | 441397.8 |
| DOEE | Downstream | RI-R3-FT-13-GT | LMB | 1/13/2015 | 1319607.7 | 441397.8 |
| DOEE | Downstream | RI-R3-FT-14-GF | STS, PKS, BG, BKF, RSF, WP, GSF | 12/30/2014 | 1320665.3 | 441868.1 |
| DOEE | Downstream | RI-R3-FT-14-GM | BG | 1/7/2015 | 1320665.3 | 441868.1 |
| DOEE | Downstream | RI-R3-FT-14-GT | LMB | 1/14/2015 | 1320665.3 | 441868.1 |
| DOEE | Downstream | RI-R4-FT-15-GF | GS, ESM, TD, BKF, STS, WP, PKS, GSF | 12/30/2014 | 1320520.6 | 442831.2 |
| DOEE | Downstream | RI-R4-FT-15-GM | PKS | 12/30/2014 | 1320520.6 | 442831.2 |
| DOEE | Downstream | RI-R4-FT-15-GT | LMB | 1/25/2015 | 1320520.6 | 442831.2 |

Notes:
(a) The fish tissue samples were collected by Tetra Tech on behalf of DOEE for the ARSP (Tetra Tech, 2018). No fish tissue samples were collected within the Waterside Investigation Area. Therefore, fish tissue samples collected within Exposure Unit 3 (EU3), which is a sampling area defined by Tetra Tech extending from the CSX bridge to New York Avenue, and also in Kingman Lake (KL), were used in the BERA.
"Upstream" samples were collected upstream of New York Avenue. "Downstream" samples were collected downstream of the CSX bridge.
The fish tissue samples were composited according to trophic level: forage fish (identified as "-GF" in the sample name), mid-level trophic fish ("GM"), and top-level or predator fish ("GT").
Species:
BKF Banded killfish
BC Black crappie
BG Bluegill
BNM Blunt nose minnow
EMF Eastern mosquitofish
ESM Eastern silvery minnow
RSF Redbreast sunfish
GSF Green sunfish
ISS Inland silverside
LMB Largemouth bass
MMC Mummichog
SB Striped bass
PKS Pumpkinseed
QB Quillback
WP White perch
YP Yellow perch
SMB Smallmouth bass
SH Snakehead
STS Spottail shiner
CCS Creek chubsucker
TD Tessellated Darter
GS Golden shiner

**Table 2-4**
**Benthic Invertebrate Tissue Samples**

| Source | Sample Identification | Tissue | Sample Date | X Coordinate | Y Coordinate |
|---|---|---|---|---|---|
| DOEE | P2-KL-08-CT | CRAYFISH | 8/18/2016 | 1321724 | 446904 |
| DOEE | P2-KL-LKL-01-BIT | SNAIL | 6/2/2016 | 1321402 | 446343 |
| DOEE | P2-KL-LKL-09-BIT | CLAM | 6/22/2016 | 1322013 | 447089 |
| DOEE | P2-KL-UKL-04-BIT | SNAIL | 6/6/2016 | 1323963 | 451746 |
| DOEE | P2-R4-FW-17-BIT | CLAM | 6/15/2016 | 1321786 | 443417 |
| DOEE | P2-R4-FW-22-BIT | SNAIL | 6/22/2016 | 1322940 | 445303 |
| DOEE | P2-R5-FW-18-BIT | SNAIL | 6/16/2016 | 1323216 | 446519 |
| DOEE | P2-R5-FW-19-BIT | CLAM | 6/16/2016 | 1323216 | 446519 |
| DOEE | P2-R6-01-CT | CRAYFISH | 8/17/2016 | 1323191 | 448312 |
| DOEE | P2-R6-02-CT | CRAYFISH | 8/18/2016 | 1323140 | 448482 |
| DOEE | P2-R6-FW-02-BIT | SNAIL | 6/3/2016 | 1323256 | 448497 |
| DOEE | P2-R6-FW-03-BIT | SNAIL | 6/3/2016 | 1323040 | 448325 |
| DOEE | P2-R6-FW-08-BIT | CLAM | 6/7/2016 | 1324251 | 451723 |

Notes:
The invertebrate tissue samples were collected by Tetra Tech on behalf of DOEE for the ARSP (DOEE, 2018) within Exposure Unit 3 (EU3), which is a sampling area defined by Tetra Tech extending from the CSX bridge to New York Avenue.

**Table 4-1**
**Sediment Ecological Screening Values**

| Detected Chemical | Low Effect ESV (a) | Low Effect ESV Source | Probable Effect ESV (b) | Probable Effect ESV Source |
|---|---|---|---|---|
| **INORGANICS** | | | | |
| Aluminum | 25000 | USEPA, 2018 | 58000 | USEPA, 2018 |
| Antimony | 2.0 | USEPA, 2006 | 3 | Buchman, 2008 |
| Arsenic | 5.9 | Buchman, 2008 | 33 | MacDonald, 2000 |
| Barium | 0.7 (c) | Buchman, 2008 | 60 | USEPA, 2018 |
| Beryllium | NV | | NV | |
| Cadmium | 0.583 | Buchman, 2008 | 4.98 | MacDonald, 2000 |
| Calcium | EN | | EN | |
| Chromium | 26 | Buchman, 2008 | 111 | MacDonald, 2000 |
| Cobalt | 50 | USEPA, 2006 | NV | |
| Copper | 31.6 | USEPA, 2006 | 149 | MacDonald, 2000 |
| Cyanide | 0.1 | USEPA, 2006 | NV | |
| Iron | 20000 | USEPA, 2006 | 40000 | Buchman, 2008 |
| Lead | 31 | Buchman, 2008 | 128 | MacDonald, 2000 |
| Magnesium | EN | | EN | |
| Manganese | 460 | Buchman, 2008 | 1100 | Buchman, 2008 |
| Mercury | 0.174 | Buchman, 2008 | 1.06 | MacDonald, 2000 |
| Nickel | 16 | Buchman, 2008 | 48.6 | MacDonald, 2000 |
| Selenium | 11 | USEPA, 2018 | 20 | USEPA, 2018 |
| Silver | 0.5 | Buchman, 2008 | 4.5 | Buchman, 2008 |
| Sodium | EN | | EN | |
| Thallium | NV | | NV | |
| Vanadium | NV | | NV | |
| Zinc | 98 | Buchman, 2008 | 459 | MacDonald, 2000 |
| **PESTICIDES** | | | | |
| 4,4'-DDD | 0.00354 | Buchman, 2008 | 0.028 | MacDonald, 2000 |
| 4,4'-DDE | 0.00316 | Buchman, 2008 | 0.0313 | MacDonald, 2000 |
| 4,4'-DDT | 0.00119 | Buchman, 2008 | 0.0629 | MacDonald, 2000 |
| Aldrin | 0.002 | Buchman, 2008 | 0.04 | Buchman, 2008 |
| alpha-BHC | 0.006 | Buchman, 2008 | NCOPC | |
| alpha-Chlordane | 0.00003 (d) | Buchman, 2008 | 0.0176 | MacDonald, 2000 |
| beta-BHC | 0.005 | Buchman, 2008 | NCOPC | |
| delta-BHC | 0.01 (d) | Buchman, 2008 | NCOPC | |
| Chlordane | 0.00324 | Buchman, 2008 | 0.0176 | MacDonald, 2000 |
| Dieldrin | 0.0019 | Buchman, 2008 | 0.0618 | MacDonald, 2000 |
| Endosulfan | 0.0029 | USEPA, 2006 | NCOPC | |
| Endosulfan II | 0.014 | USEPA, 2006 | NCOPC | |
| Endosulfan sulfate | 0.0054 | USEPA, 2006 | NV | |
| Endrin | 0.00222 | Buchman, 2008 | 0.207 | MacDonald, 2000 |
| Endrin aldehyde | 0.00222 (e) | Buchman, 2008 | NCOPC | |
| Endrin ketone | 0.00222 (e) | Buchman, 2008 | 0.207 (e) | MacDonald, 2000 |
| gamma-BHC (Lindane) | 0.00237 | Buchman, 2008 | NCOPC | |
| gamma-Chlordane | 0.00003 (d) | Buchman, 2008 | 0.0176 | MacDonald, 2000 |
| Heptachlor | 0.01 | Buchman, 2008 | nCOPC | |
| Heptachlor epoxide | 0.0006 | Buchman, 2008 | 0.016 | MacDonald, 2000 |
| Methoxychlor | 0.0187 | USEPA, 2006 | 0.059 | USEPA, 2018 |
| **POLYCHLORINATED BIPHENYLs** | | | | |
| Aroclor-1242 | 0.026 (e) | Buchman, 2008 | NCOPC | |
| Aroclor-1248 | 0.026 (f) | Buchman, 2008 | 0.676 (f) | MacDonald, 2000 |
| Aroclor-1254 | 0.06 | Buchman, 2008 | 0.34 | Buchman, 2008 |
| Aroclor-1260 | 0.026 (f) | Buchman, 2008 | 0.676 (f) | MacDonald, 2000 |
| Total PCBs | 0.026 | Buchman, 2008 | 0.676 | MacDonald, 2000 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS** | | | | |
| 1,1'-Biphenyl | 1.22 | USEPA, 2006 | NCOPC | |
| 1-Methylnaphthalene | 0.141 | USEPA, 2018 | NV | |
| 2,3,5-Trimethylnaphthalene | NV | | NV | |
| 2,4-Dimethylphenol | 0.029 | USEPA, 2006 | NCOPC | |
| 2,6-Dimethylnaphthalene | NV | | NV | |
| 2-Methylnaphthalene | 0.0202 | USEPA, 2006 | NV | |
| 4-Chloroaniline | 0.0009 | USEPA, 2018 | 0.021 | USEPA, 2018 |
| 4-Methylphenol | 0.0051 | Buchman, 2008 | NV | |
| Acenaphthene | 0.00671 | Buchman, 2008 | NV | |
| Acenaphthylene | 0.00587 | Buchman, 2008 | 0.16 | Buchman, 2008 |
| Acetophenone | NV | | NV | |
| Anthracene | 0.01 | Buchman, 2008 | 0.845 | MacDonald, 2000 |
| Benzaldehyde | 0.059 | USEPA, 2018 | 0.58 | USEPA, 2018 |
| Benzo(a) pyrene | 0.0319 | Buchman, 2008 | 1.45 | MacDonald, 2000 |
| Benzo(a)anthracene | 0.01572 | Buchman, 2008 | 1.05 | MacDonald, 2000 |
| Benzo(b) fluoranthene | 0.19 | USEPA, 2018 | 2.23 (i) | MacDonald, 2000 |
| Benzo(e)pyrene | 0.0319 (i) | Buchman, 2008 | 1.45 (h) | MacDonald, 2000 |

**Table 4-1**
**Sediment Ecological Screening Values**

| Detected Chemical | Low Effect ESV (a) | | Low Effect ESV Source | Probable Effect ESV (b) | Probable Effect ESV Source |
|---|---|---|---|---|---|
| Benzo(g,h,i) perylene | 0.17 | | Buchman, 2008 | 0.3 | Buchman, 2008 |
| Benzo(k) fluoranthene | 0.0272 | | Buchman, 2008 | 13.4 | Buchman, 2008 |
| Benzoic acid | 0.019 | | USEPA, 2018 | 2 | USEPA, 2018 |
| Bis(2-ethylhexyl) phthalate | 0.1 | | Buchman, 2008 | 0.75 | Buchman, 2008 |
| Butylbenzylphthalate | 0.1 | | Buchman, 2008 | 0.481 | USEPA, 2018 |
| Caprolactam | NV | | | NV | |
| Carbazole | 0.069 | | USEPA, 2018 | 4.561 | USEPA, 2018 |
| Chrysene | 0.027 | | Buchman, 2008 | 1.29 | MacDonald, 2000 |
| Dibenzo(a,h) anthracene | 0.0062 | | Buchman, 2008 | 0.1 | Buchman, 2008 |
| Dibenzofuran | 5.1 | | Buchman, 2008 | NCOPC | |
| Diethylphthalate | 0.53 | | Buchman, 2008 | NCOPC | |
| Di-n-butylphthalate | 0.44 | (g) | Buchman, 2008 | NCOPC | |
| Di-n-octylphthalate | 0.1 | (d) | Buchman, 2008 | NV | |
| Fluoranthene | 0.031 | | Buchman, 2008 | 2.23 | MacDonald, 2000 |
| Fluorene | 0.01 | | Buchman, 2008 | 0.536 | MacDonald, 2000 |
| Indeno(1,2,3,-cd) pyrene | 0.017 | | Buchman, 2008 | 0.33 | Buchman, 2008 |
| Naphthalene | 0.015 | | Buchman, 2008 | 0.561 | MacDonald, 2000 |
| Perylene | NV | | | NV | |
| Phenanthrene | 0.019 | | Buchman, 2008 | 1.17 | MacDonald, 2000 |
| Phenol | 0.048 | | Buchman, 2008 | nCOPC | |
| Pyrene | 0.044 | | Buchman, 2008 | 1.52 | MacDonald, 2000 |
| Total PAHs | 0.26 | | Buchman, 2008 | 22.8 | MacDonald, 2000 |
| Total LMW PAHs | 0.076 | | Buchman, 2008 | 5.3 | Buchman, 2008 |
| Total HMW PAHs | 0.193 | | Buchman, 2008 | 6.5 | Buchman, 2008 |
| **VOLATILE ORGANIC COMPOUNDS** | | | | | |
| 2-Butanone | 35 | (d) | Buchman, 2008 | NCOPC | |
| Acetone | 0.065 | | USEPA, 2018 | 38 | USEPA, 2018 |
| Chloroform | 0.02 | (d) | Buchman, 2008 | NCOPC | |
| **DIOXIN/FURANs** | | | | | |
| 1,2,3,4,6,7,8-HpCDD | NV | | | NV | |
| 1,2,3,4,6,7,8-HpCDF | NV | | | NV | |
| 1,2,3,4,7,8,9-HpCDF | NV | | | NV | |
| 1,2,3,4,7,8-HxCDD | NV | | | NV | |
| 1,2,3,4,7,8-HxCDF | NV | | | NV | |
| 1,2,3,6,7,8-HxCDD | NV | | | NV | |
| 1,2,3,6,7,8-HxCDF | NV | | | NV | |
| 1,2,3,7,8,9-HxCDD | NV | | | NV | |
| 1,2,3,7,8,9-HxCDF | NV | | | NV | |
| 1,2,3,7,8-PeCDD | NV | | | NV | |
| 1,2,3,7,8-PeCDF | NV | | | NV | |
| 2,3,4,6,7,8-HxCDF | NV | | | NV | |
| 2,3,4,7,8-PeCDF | NV | | | NV | |
| 2,3,7,8-TCDD | NV | | | NV | |
| 2,3,7,8-TCDF | NV | | | NV | |
| OCDD | NV | | | NV | |
| OCDF | NV | | | NV | |

Notes:
All screening values reported in milligrams per kilogram (mg/kg).
EN - Essential nutrient.
NCOPC - Not identified as a COPC following the screen comparing Low Effect ESVs to maximum detected concentrations.
NOAA - National Oceanic and Atmospheric Administration.
NV - No value identified.
OMOE - Ontario Ministry of Environment and Energy
TCDD TEQ - Tetrachlorodibenzo-p-dioxin Toxicity Equivalency Factor
USEPA - United States Environmental Protection Agency.
ESVs are presented for detected chemicals only.
(a) Low effect ESVs selected based on a hierarchy of freshwater values from NOAA SQuiRT tables (Buchman 2008), USEPA Region 3 freshwater sediment screening values (USEPA 2006), USEPA Region 5 Ecological Screening Levels (USEPA 2003), and USEPA Region 4 recommended ecological screening values (USEPA, 2018).
(b) Probable effect ESVs are based on the Probable Effects Concentrations (MacDonald et al. 2000), or either the Upper Effects Thresholds (UET) or Severe Effect Level (SEL) if the UET was not available (Buchman, 2008), and USEPA Region 4 recommended refined Screening Value (USEPA, 2018).
(c) Background value for freshwater sediment (Buchman 2008).
(d) Target standard from E.M.J Verbruggen, R. Posthumus, and A.P. van Wezel. 2001. Ecotoxicological Serious Risk Concentrations for soil, sediment, and groundwater. Risk limits are typically divided by 100 to derive the Target value.
(e) Value for endrin used due to structural similarities.
(f) Value for Total PCBs used for individual Aroclors without screening values.
(g) Upper Effects Thresholds (Buchman, 2008), based on median Study Area TOC (4.05%).
(h) Screening value is not available. Value for Benzo(a) pyrene is used due to structural similarities.
(i) Screening value is not available. Value for fluoranthene is used due to structural similarities.

**Table 4-2**
**Identification of Sediment COPCs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Detected Analyte | FOD | Detected Concentrations Minimum | Mean | Maximum | Selected Sediment ESV (a) | COPC Determination and Rationale |
|---|---|---|---|---|---|---|
| **INORGANICS** | | | | | | |
| Aluminum | 84 : 84 | 1.90E+03 | 8.42E+03 | 1.80E+04 | 2.50E+04 | No - Max detect < ESV |
| Antimony | 83 : 84 | 5.00E-02 | 1.22E+00 | 4.30E+01 | 2.00E+00 | Yes - Max detect > ESV |
| Arsenic | 84 : 84 | 7.90E-01 | 4.52E+00 | 1.70E+01 | 5.90E+00 | Yes - Max detect > ESV |
| Barium | 84 : 84 | 1.70E+01 | 8.44E+01 | 1.80E+02 | 7.00E-01 | Yes - Max detect > ESV |
| Beryllium | 84 : 84 | 1.50E-01 | 1.07E+00 | 2.20E+00 | NV | Yes - No ESV |
| Cadmium | 84 : 84 | 2.40E-01 | 1.20E+00 | 5.20E+00 | 5.83E-01 | Yes - Max detect > ESV |
| Calcium | 84 : 84 | 8.70E+02 | 3.22E+03 | 1.70E+04 | EN | EN |
| Chromium | 84 : 84 | 1.10E+01 | 3.91E+01 | 1.40E+02 | 2.60E+01 | Yes - Max detect > ESV |
| Cobalt | 84 : 84 | 4.80E+00 | 1.53E+01 | 3.20E+01 | 5.00E+01 | No - Max detect < ESV |
| Copper | 84 : 84 | 9.60E+00 | 5.67E+01 | 2.40E+02 | 3.16E+01 | Yes - Max detect > ESV |
| Cyanide | 15 : 20 | 1.50E-01 | 8.33E-01 | 4.90E+00 | 1.00E-01 | Yes - Max detect > ESV |
| Iron | 84 : 84 | 7.50E+03 | 2.09E+04 | 3.40E+04 | 2.00E+04 | Yes - Max detect > ESV |
| Lead | 84 : 84 | 1.10E+01 | 7.60E+01 | 3.20E+02 | 3.10E+01 | Yes - Max detect > ESV |
| Magnesium | 84 : 84 | 6.40E+02 | 3.03E+03 | 1.20E+04 | EN | EN |
| Manganese | 84 : 84 | 8.60E+01 | 2.74E+02 | 5.90E+02 | 4.60E+02 | Yes - Max detect > ESV |
| Mercury | 84 : 84 | 3.30E-02 | 1.97E-01 | 6.90E-01 | 1.74E-01 | Yes - Max detect > ESV |
| Nickel | 84 : 84 | 7.70E+00 | 3.88E+01 | 1.60E+02 | 1.60E+01 | Yes - Max detect > ESV |
| Potassium | 84 : 84 | 2.30E+02 | 1.03E+03 | 2.10E+03 | EN | EN |
| Selenium | 84 : 84 | 3.40E-02 | 9.30E-01 | 2.75E+00 | 1.10E+01 | No - Max detect < ESV |
| Silver | 84 : 84 | 4.40E-02 | 5.19E-01 | 3.50E+00 | 5.00E-01 | Yes - Max detect > ESV |
| Sodium | 84 : 84 | 2.50E+01 | 1.57E+02 | 4.20E+02 | EN | EN |
| Thallium | 84 : 84 | 3.70E-02 | 2.01E-01 | 6.30E-01 | NV | Yes - No ESV |
| Vanadium | 84 : 84 | 8.50E+00 | 6.00E+01 | 4.40E+02 | NV | Yes - No ESV |
| Zinc | 84 : 84 | 4.60E+01 | 2.23E+02 | 6.30E+02 | 9.80E+01 | Yes - Max detect > ESV |
| **PESTICIDES** | | | | | | |
| 4,4'-DDD | 49 : 49 | 7.60E-04 | 5.90E-03 | 6.80E-02 | 3.54E-03 | Yes - Max detect > ESV |
| 4,4'-DDE | 48 : 49 | 1.40E-03 | 9.61E-03 | 5.60E-02 | 3.16E-03 | Yes - Max detect > ESV |
| 4,4'-DDT | 33 : 49 | 3.70E-04 | 5.10E-02 | 1.50E+00 | 1.19E-03 | Yes - Max detect > ESV |
| Aldrin | 30 : 49 | 7.40E-05 | 5.97E-04 | 3.00E-03 | 2.00E-03 | Yes - Max detect > ESV |
| alpha-BHC | 2 : 49 | 1.30E-04 | 1.90E-04 | 2.40E-04 | 6.00E-03 | No - Max detect < ESV |
| beta-BHC | 11 : 49 | 2.90E-04 | 1.13E-03 | 3.90E-03 | 5.00E-03 | No - Max detect < ESV |
| cis-Chlordane | 29 : 29 | 1.40E-03 | 7.70E-03 | 1.80E-02 | 3.00E-05 | Yes - Max detect > ESV |
| delta-BHC | 20 : 49 | 1.80E-04 | 1.20E-03 | 5.50E-03 | 1.00E-02 | No - Max detect < ESV |
| Dieldrin | 39 : 49 | 2.60E-04 | 2.30E-03 | 1.40E-02 | 1.90E-03 | Yes - Max detect > ESV |
| Endosulfan I | 7 : 49 | 3.70E-04 | 7.70E-04 | 1.50E-03 | 2.90E-03 | No - Max detect < ESV |
| Endosulfan II | 30 : 49 | 1.80E-04 | 1.40E-03 | 6.80E-03 | 1.40E-02 | No - Max detect < ESV |
| Endosulfan Sulfate | 30 : 48 | 1.70E-04 | 2.11E-03 | 1.10E-02 | 5.40E-03 | Yes - Max detect > ESV |
| Endrin | 36 : 49 | 3.10E-04 | 4.35E-03 | 2.20E-02 | 2.22E-03 | Yes - Max detect > ESV |
| Endrin aldehyde | 24 : 49 | 1.60E-04 | 7.90E-04 | 2.10E-03 | 2.22E-03 | No - Max detect < ESV |
| Endrin ketone | 12 : 28 | 5.20E-04 | 3.00E-03 | 8.00E-03 | 2.22E-03 | Yes - Max detect > ESV |
| gamma-BHC (Lindane) | 27 : 49 | 7.70E-05 | 4.80E-04 | 1.60E-03 | 2.37E-03 | No - Max detect < ESV |
| Chlordane (technical) | 14 : 15 | 2.20E-02 | 5.70E-02 | 1.30E-01 | 3.00E-05 | Yes - Max detect > ESV |
| Heptachlor | 30 : 49 | 2.10E-04 | 1.53E-03 | 7.10E-03 | 1.00E-02 | No - Max detect < ESV |
| Heptachlor Epoxide | 46 : 49 | 1.20E-04 | 1.50E-03 | 6.50E-03 | 6.00E-04 | Yes - Max detect > ESV |
| Methoxychlor | 14 : 28 | 1.70E-03 | 1.30E-02 | 2.70E-02 | 1.87E-02 | Yes - Max detect > ESV |
| trans-Chlordane | 24 : 29 | 1.90E-03 | 1.00E-02 | 3.10E-02 | 3.00E-05 | Yes - Max detect > ESV |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | |
| Aroclor-1242 | 1 : 84 | 2.50E-01 | 2.50E-01 | 2.50E-01 | 2.60E-02 | No - Max detect < ESV |
| Aroclor-1248 | 71 : 84 | 1.50E-02 | 1.80E-01 | 8.90E-01 | 2.60E-02 | Yes - Max detect > ESV |
| Aroclor-1254 | 21 : 84 | 1.90E-02 | 1.00E-01 | 2.50E-01 | 6.00E-02 | Yes - Max detect > ESV |
| Aroclor-1260 | 83 : 84 | 3.10E-03 | 1.34E-01 | 1.00E+00 | 2.60E-02 | Yes - Max detect > ESV |
| PCB, Total Congeners | 32 : 32 | 3.80E-02 | 9.05E-01 | 1.18E+01 | 2.60E-02 | Yes - Max detect > ESV |
| PCB, Total Aroclors | 83 : 84 | 3.10E-03 | 3.13E-01 | 1.90E+00 | 2.60E-02 | Yes - Max detect > ESV |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | |
| 1,1'-Biphenyl | 1 : 14 | 1.80E-02 | 1.80E-02 | 1.80E-02 | 1.22E+00 | No - Max detect < ESV |
| 2,4-Dimethylphenol | 2 : 34 | 2.70E-02 | 2.70E-02 | 2.70E-02 | 2.90E-02 | No - Max detect < ESV |
| 2-Methylnaphthalene | 13 : 14 | 9.20E-03 | 3.90E-02 | 8.20E-02 | 2.02E-02 | Yes - Max detect > ESV |
| 4-Chloroaniline | 2 : 14 | 5.70E-02 | 7.00E-02 | 8.20E-02 | 9.00E-04 | Yes - Max detect > ESV |
| 4-Methylphenol | 6 : 14 | 2.70E-02 | 7.30E-02 | 1.10E-01 | 5.10E-03 | Yes - Max detect > ESV |
| Acenaphthene | 55 : 69 | 7.70E-03 | 5.24E-02 | 4.30E-01 | 6.71E-03 | Yes - Max detect > ESV |
| Acenaphthylene | 57 : 69 | 1.60E-02 | 6.50E-02 | 1.70E-01 | 5.87E-03 | Yes - Max detect > ESV |
| Acetophenone | 6 : 14 | 1.50E-02 | 3.10E-02 | 4.40E-02 | NV | Yes - No ESV |
| Anthracene | 66 : 69 | 1.60E-02 | 1.34E-01 | 8.60E-01 | 1.00E-02 | Yes - Max detect > ESV |
| Benzaldehyde | 11 : 13 | 2.40E-02 | 1.50E-01 | 3.20E-01 | 5.90E-02 | Yes - Max detect > ESV |
| Benzo(a)anthracene | 68 : 69 | 2.10E-02 | 5.30E-01 | 2.30E+00 | 1.57E-02 | Yes - Max detect > ESV |
| Benzo(a)pyrene | 68 : 69 | 2.80E-02 | 6.00E-01 | 2.00E+00 | 3.19E-02 | Yes - Max detect > ESV |
| Benzo(b)fluoranthene | 68 : 69 | 4.30E-02 | 9.00E-01 | 2.60E+00 | 1.90E-01 | Yes - Max detect > ESV |
| Benzo(g,h,i)perylene | 68 : 69 | 2.90E-02 | 6.49E-01 | 1.70E+00 | 1.70E-01 | Yes - Max detect > ESV |
| Benzo(k)fluoranthene | 67 : 69 | 6.60E-02 | 3.32E-01 | 9.60E-01 | 2.72E-02 | Yes - Max detect > ESV |
| Benzoic acid | 10 : 20 | 7.50E-01 | 1.10E+00 | 1.40E+00 | 1.90E-02 | Yes - Max detect > ESV |
| bis-(2-Ethylhexyl)phthalate | 34 : 34 | 2.10E-01 | 1.51E+00 | 1.00E+01 | 1.00E-01 | Yes - Max detect > ESV |
| Butylbenzylphthalate | 17 : 34 | 4.30E-02 | 2.40E-01 | 2.50E+00 | 1.00E-01 | Yes - Max detect > ESV |
| Caprolactam | 1 : 14 | 3.90E-01 | 3.90E-01 | 3.90E-01 | NV | Yes - No ESV |
| Carbazole | 14 : 14 | 2.30E-02 | 9.30E-02 | 2.50E-01 | 6.90E-02 | Yes - Max detect > ESV |
| Chrysene | 68 : 69 | 3.10E-02 | 8.14E-01 | 2.40E+00 | 2.68E-02 | Yes - Max detect > ESV |
| Di-n-butylphthalate | 5 : 34 | 2.30E-02 | 6.90E-02 | 2.00E-01 | 4.40E-01 | No - Max detect < ESV |
| Di-n-octylphthalate | 7 : 34 | 4.20E-02 | 2.20E-01 | 4.00E-01 | 1.00E-01 | Yes - Max detect > ESV |
| Dibenzo(a,h)anthracene | 65 : 69 | 2.40E-02 | 1.40E-01 | 4.70E-01 | 6.22E-03 | Yes - Max detect > ESV |
| Dibenzofuran | 4 : 14 | 2.70E-02 | 6.20E-02 | 1.10E-01 | 5.10E+00 | No - Max detect < ESV |
| Diethylphthalate | 2 : 34 | 4.80E-02 | 8.40E-02 | 1.20E-01 | 5.30E-01 | No - Max detect < ESV |
| Fluoranthene | 68 : 69 | 3.70E-02 | 1.30E+00 | 6.00E+00 | 3.15E-02 | Yes - Max detect > ESV |
| Fluorene | 58 : 69 | 1.20E-02 | 6.30E-02 | 4.10E-01 | 1.00E-02 | Yes - Max detect > ESV |
| Indeno(1,2,3-cd)pyrene | 68 : 69 | 2.20E-02 | 5.20E-01 | 1.40E+00 | 1.73E-02 | Yes - Max detect > ESV |
| Naphthalene | 37 : 69 | 4.90E-03 | 3.70E-02 | 1.30E-01 | 1.47E-02 | Yes - Max detect > ESV |
| Phenanthrene | 67 : 69 | 9.20E-02 | 5.58E-01 | 4.40E+00 | 1.87E-02 | Yes - Max detect > ESV |
| Phenol | 2 : 34 | 3.40E-02 | 3.80E-02 | 4.10E-02 | 4.80E-02 | No - Max detect < ESV |
| Pyrene | 68 : 69 | 3.60E-02 | 9.98E-01 | 4.00E+00 | 4.43E-02 | Yes - Max detect > ESV |
| Total High-molecular-weight PAHs | 68 : 69 | 2.50E-01 | 6.77E+00 | 2.40E+01 | 1.93E-01 | Yes - Max detect > ESV |
| Total Low-molecular-weight PAHs | 67 : 69 | 1.50E-01 | 8.62E-01 | 6.30E+00 | 7.64E-02 | Yes - Max detect > ESV |
| Total PAHs (sum 16) | 68 : 69 | 2.50E-01 | 7.60E+00 | 3.00E+01 | 2.64E-01 | Yes - Max detect > ESV |

**Table 4-2**
**Identification of Sediment COPCs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Detected Analyte | FOD | Detected Concentrations Minimum | Mean | Maximum | Selected Sediment ESV (a) | COPC Determination and Rationale |
|---|---|---|---|---|---|---|
| **SVOCs (method ID0016)** | | | | | | |
| 1-Methylnaphthalene | 34 : 39 | 1.50E-02 | 5.82E-02 | 2.39E-01 | 1.41E-01 | Yes - Max detect > ESV |
| 2,3,5-Trimethylnaphthalene | 22 : 22 | 8.90E-03 | 6.41E-02 | 3.90E-01 | NV | Yes - No ESV |
| 2,6-Dimethylnaphthalene | 22 : 22 | 1.60E-02 | 9.30E-02 | 3.00E-01 | NV | Yes - No ESV |
| 2-Methylnaphthalene | 26 : 39 | 2.90E-02 | 1.12E-01 | 4.00E-01 | 2.02E-02 | Yes - Max detect > ESV |
| Acenaphthene | 39 : 39 | 1.67E-02 | 4.36E-02 | 1.22E-01 | 6.71E-03 | Yes - Max detect > ESV |
| Acenaphthylene | 39 : 39 | 1.10E-02 | 2.72E-02 | 1.30E-01 | 5.87E-03 | Yes - Max detect > ESV |
| Anthracene | 39 : 39 | 6.40E-02 | 1.18E-01 | 3.30E-01 | 1.00E-02 | Yes - Max detect > ESV |
| Benzo(a)anthracene | 39 : 39 | 2.10E-01 | 7.58E-01 | 1.60E+00 | 1.57E-02 | Yes - Max detect > ESV |
| Benzo(a)pyrene | 39 : 39 | 2.50E-01 | 9.47E-01 | 2.20E+00 | 3.19E-02 | Yes - Max detect > ESV |
| Benzo(b)fluoranthene | 39 : 39 | 4.10E-01 | 1.51E+00 | 3.20E+00 | 1.90E-01 | Yes - Max detect > ESV |
| Benzo(e)pyrene | 39 : 39 | 2.70E-01 | 8.57E-01 | 1.90E+00 | 3.19E-02 | Yes - Max detect > ESV |
| Benzo(g,h,i)perylene | 39 : 39 | 2.50E-01 | 8.63E-01 | 1.70E+00 | 1.70E-01 | Yes - Max detect > ESV |
| Benzo(k)fluoranthene | 39 : 39 | 2.10E-01 | 6.85E-01 | 1.50E+00 | 2.72E-02 | Yes - Max detect > ESV |
| Chrysene | 39 : 39 | 5.10E-01 | 1.38E+00 | 2.80E+00 | 2.68E-02 | Yes - Max detect > ESV |
| Dibenzo(a,h)anthracene | 39 : 39 | 5.10E-02 | 1.39E-01 | 2.30E-01 | 6.22E-03 | Yes - Max detect > ESV |
| Fluoranthene | 39 : 39 | 4.40E-01 | 1.67E+00 | 3.70E+00 | 3.15E-02 | Yes - Max detect > ESV |
| Fluorene | 39 : 39 | 3.40E-02 | 7.10E-02 | 1.80E-01 | 1.00E-02 | Yes - Max detect > ESV |
| Indeno(1,2,3-cd)pyrene | 39 : 39 | 1.90E-01 | 6.93E-01 | 1.50E+00 | 1.73E-02 | Yes - Max detect > ESV |
| Naphthalene | 18 : 39 | 4.00E-02 | 9.50E-02 | 2.04E-01 | 1.47E-02 | Yes - Max detect > ESV |
| Perylene | 39 : 39 | 1.30E-01 | 3.15E-01 | 6.00E-01 | NV | Yes - No ESV |
| Phenanthrene | 39 : 39 | 3.10E-01 | 7.24E-01 | 1.87E+00 | 1.87E-02 | Yes - Max detect > ESV |
| Pyrene | 39 : 39 | 5.40E-01 | 1.51E+00 | 3.20E+00 | 4.43E-02 | Yes - Max detect > ESV |
| Total High-molecular-weight PAHs | 39 : 39 | 3.10E+00 | 1.01E+01 | 2.20E+01 | 1.93E-01 | Yes - Max detect > ESV |
| Total Low-molecular-weight PAHs | 39 : 39 | 5.54E-01 | 1.02E+00 | 2.74E+00 | 7.64E-02 | Yes - Max detect > ESV |
| Total PAHs (sum 16) | 39 : 39 | 3.90E+00 | 1.12E+01 | 2.30E+01 | 2.64E-01 | Yes - Max detect > ESV |
| **VOLATILE ORGANIC COMPOUNDS (VOCs)** | | | | | | |
| 2-Butanone | 1 : 14 | 1.20E-02 | 1.20E-02 | 1.20E-02 | 3.50E+01 | No - Max detect < ESV |
| Acetone | 2 : 14 | 2.00E-02 | 3.80E-02 | 5.50E-02 | 6.50E-02 | No - Max detect < ESV |
| Chloroform | 2 : 32 | 1.10E-03 | 1.30E-03 | 1.40E-03 | 2.00E-02 | No - Max detect < ESV |
| **DIOXIN/FURANS** | | | | | | |
| 2,3,7,8-TCDD | 34 : 41 | 5.93E-08 | 3.20E-06 | 3.82E-05 | NV | Yes - No ESV |
| 1,2,3,7,8-PeCDD | 39 : 41 | 4.26E-08 | 1.67E-05 | 2.77E-04 | NV | Yes - No ESV |
| 1,2,3,6,7,8-HxCDD | 41 : 41 | 2.65E-07 | 3.32E-05 | 5.48E-04 | NV | Yes - No ESV |
| 1,2,3,4,7,8-HxCDD | 39 : 41 | 1.58E-07 | 1.84E-05 | 2.89E-04 | NV | Yes - No ESV |
| 1,2,3,7,8,9-HxCDD | 40 : 41 | 2.09E-07 | 4.31E-05 | 7.05E-04 | NV | Yes - No ESV |
| 1,2,3,4,6,7,8-HpCDD | 41 : 41 | 8.42E-06 | 3.04E-04 | 4.10E-03 | NV | Yes - No ESV |
| OCDD | 41 : 41 | 3.38E-04 | 3.58E-03 | 1.47E-02 | NV | Yes - No ESV |
| 2,3,7,8-TCDF | 40 : 41 | 1.27E-07 | 5.39E-06 | 5.67E-05 | NV | Yes - No ESV |
| 1,2,3,7,8-PeCDF | 38 : 41 | 1.13E-07 | 8.82E-06 | 1.24E-04 | NV | Yes - No ESV |
| 2,3,4,7,8-PeCDF | 38 : 41 | 3.45E-07 | 1.76E-05 | 2.17E-04 | NV | Yes - No ESV |
| 1,2,3,6,7,8-HxCDF | 36 : 41 | 1.05E-07 | 2.00E-05 | 2.72E-04 | NV | Yes - No ESV |
| 1,2,3,7,8,9-HxCDF | 27 : 41 | 5.83E-08 | 2.21E-06 | 2.43E-05 | NV | Yes - No ESV |
| 1,2,3,4,7,8-HxCDF | 39 : 41 | 9.02E-08 | 3.09E-05 | 4.70E-04 | NV | Yes - No ESV |
| 2,3,4,6,7,8-HxCDF | 39 : 41 | 7.37E-08 | 1.97E-05 | 2.85E-04 | NV | Yes - No ESV |
| 1,2,3,4,6,7,8-HpCDF | 41 : 41 | 2.37E-07 | 7.74E-05 | 1.08E-03 | NV | Yes - No ESV |
| 1,2,3,4,7,8,9-HpCDF | 37 : 41 | 8.00E-08 | 1.04E-05 | 1.51E-04 | NV | Yes - No ESV |
| OCDF | 39 : 41 | 5.14E-07 | 8.92E-05 | 1.00E-03 | NV | Yes - No ESV |

Notes:
All concentrations reported in milligrams per kilogram (mg/kg).
Hazard quotient is calculated by dividing the maximum detected concentration by the ESV.
COPC - Constituent of Potential Concern.
EN - Essential Nutrient.
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
NC - Not Calculated.
nCOPC - Not a COPC.
NOAA - National Oceanic and Atmospheric Administration.
NV - No Value.
OMOE - Ontario Ministry of Environment and Energy.
PAH - Polycyclic Aromatic Hydrocarbon.
SQuiRTs - Screening Quick Reference Tables.
USEPA - United States Environmental Protection Agency.
(a) Screening values selected based on a hierarchy of freshwater values from NOAA SQuirTs (Buchman 2008), USEPA Region 3 freshwater sediment screening values (USEPA 2006a), USEPA Region 5 ESLs (USEPA 2003), OMOE (Persaud 1993) and USEPA Region 4 recommended ecological screening values (USEPA, 2018). See Table 3-1 for sediment ecological screening levels.

**Table 4-3**
**Evaluation of SEM, AVS, and TOC**

| | | Site Locations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Location | | SED6.5D00EN | SED6.5E00EN | SED6A00EN | SED6B00EN | SED6C00EN | SED7.5D00EN | SED7.5E00EN | SED7A00EN |
| Sample Date | | 7/4/2017 | 6/8/2017 | 6/8/2017 | 6/8/2017 | 6/7/2017 | 6/9/2017 | 6/8/2017 | 6/9/2017 |
| Unit | | | | | | | | | |
| TOTAL ORGANIC CARBON | mg/kg | 65000 J | 70000 | 83000 | 21000 | 96000 | 50000 J | 94000 | 79000 J |
| ACID VOLATILE SULFIDES | umol/g | 2.2 | 8.2 | 9.5 | 1.1 | 1.3 J | 0.78 J | 28 | 1.4 |
| CADMIUM | umol/g | 0.02 | 0.02 | 0.0048 | 0.0043 | 0.0069 | 0.014 | 0.022 | 0.0067 |
| COPPER | umol/g | 0.46 | 0.45 | 0.3 | 0.25 | 0.57 | 0.57 | 0.051 | 0.73 |
| LEAD | umol/g | 0.46 | 0.94 | 0.21 | 0.13 | 0.29 | 0.47 | 0.46 | 0.28 |
| NICKEL | umol/g | 0.36 | 0.35 | 0.27 | 0.17 | 0.34 | 0.47 | 0.76 | 0.39 |
| SILVER | umol/g | < 0.0026 U | < 0.0028 U | < 0.0033 U | < 0.0023 U | < 0.0035 U | < 0.0027 U | < 0.0033 U | < 0.0034 U |
| ZINC | umol/g | 4.4 | 4.4 | 2.3 | 1.5 | 3.1 | 4.3 | 6.6 | 3.5 |
| | | | | | | | | | |
| Sum SEM | umol/g | 5.70 | 6.16 | 3.08 | 2.05 | 4.31 | 5.82 | 7.89 | 4.91 |
| Sum SEM / AVS | unitless | **2.59** | 0.75 | 0.32 | **1.87** | **3.31** | **7.47** | 0.28 | **3.50** |
| Sum SEM - AVS | umol/g | **3.5** | -2.0 | -6.42 | **0.95** | **3.01** | **5.04** | -20.11 | **3.51** |
| [Sum SEM - AVS]/goc | umol/$g_{oc}$ | 54 | -29 | -77 | 45 | 31 | 101 | -214 | 44 |

Notes:
Sum SEM is the sum of detected concentrations only.
J - Estimated concentration (-/+ biased).
mg/kg - milligram/kilogram.
NC - Not calculated due to non-detect AVS value.
R - The analyte of interest may or may not be present at the 95% confidence level and theresult is know to be inaccurate or imprecise.
U - Not detected.
umol/g - micromole per gram
umol/goc - micromole per gram organic carbon
**Bold text indicates Sum SEM / AVS is greater than 1 or Sum SEM - AVS is greater than 0.**

USEPA (2005) guidance on metals bioavailability evaluates possible binding of metals by both AVS and organic matter and provides the following scale to evaluate whether or not the organic carbon binding phase (represented as fraction organic carbon or foc), in conjunction with the AVS, is affecting the bioavailability of divalent metals in sediments:

If the (∑SEM-AVS)/foc exceeds 3000 µmol/goc, the sediments are presumed to be "likely to be toxic";
If the (∑SEM-AVS)/foc is between 130 and 3,000 µmol/goc, predictions of effects are uncertain; and
If the (∑SEM-AVS)/foc is less than 130 µmol/goc, the sediments are presumed to "not likely" be toxic.

**Table 4-3**
**Evaluation of SEM, AVS, and TOC**

| | | Site Locations | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Location | | SED7B00EN | | SED7D00EN | | SED7E00EN | | SED7F00EN | | SED8A00EN | | SED8B00EN | | SED8C00EN | |
| Sample Date | | 6/7/2017 | | 6/9/2017 | | 6/8/2017 | | 6/8/2017 | | 6/9/2017 | | 6/9/2017 | | 6/7/2017 | |
| | Unit | | | | | | | | | | | | | | |
| TOTAL ORGANIC CARBON | mg/kg | 31000 | | 58000 | J | 45000 | | 58000 | | 66000 | J | 67000 | J | 44000 | |
| ACID VOLATILE SULFIDES | umol/g | 2.2 | | < 1.1 | U | 7.3 | | 1.3 | | 0.74 | J | < 1.2 | U | 3.5 | |
| CADMIUM | umol/g | 0.0063 | | 0.01 | | 0.014 | | 0.017 | | 0.0062 | | 0.0052 | | 0.0061 | |
| COPPER | umol/g | 0.33 | | 0.58 | | 0.39 | | 0.87 | | 0.6 | | 0.51 | | 0.56 | |
| LEAD | umol/g | 0.26 | | 0.31 | | 0.4 | | 0.55 | | 0.28 | | 0.23 | | 0.24 | |
| NICKEL | umol/g | 0.26 | | 0.37 | | 0.47 | | 0.55 | | 0.32 | | 0.29 | | 0.3 | |
| SILVER | umol/g | < 0.0031 | U | < 0.0028 | U | < 0.0021 | U | < 0.0027 | U | < 0.0032 | U | < 0.0031 | U | < 0.0030 | U |
| ZINC | umol/g | 2.4 | | 3.5 | | 4.5 | | 5.1 | | 2.8 | | 2.6 | | 2.7 | |
| | | | | | | | | | | | | | | | |
| Sum SEM | umol/g | 3.26 | | 4.77 | | 5.77 | | 7.09 | | 4.0 | | 3.64 | | 3.81 | |
| Sum SEM / AVS | unitless | **1.48** | | NC | | 0.79 | | **5.45** | | **5.41** | | NC | | **1.09** | |
| Sum SEM - AVS | umol/g | **1.06** | | **4.77** | | -1.5 | | **5.79** | | **3.3** | | **3.64** | | **0.31** | |
| [Sum SEM - AVS]/goc | umol/$g_{oc}$ | 34 | | 82 | | -34 | | 100 | | 49 | | 54 | | 7 | |

Notes:
Sum SEM is the sum of detected concentrations only.
J - Estimated concentration (-/+ biased).
mg/kg - milligram/kilogram.
NC - Not calculated due to non-detect AVS value.
R - The analyte of interest may or may not be present at the 95% confidence level and theresult is know to be inaccurate or imprecise.
U - Not detected.
umol/g - micromole per gram
umol/goc - micromole per gram organic carbon
**Bold text indicates Sum SEM / AVS is greater than 1 or Sum SEM - AVS is greater than 0.**

USEPA (2005) guidance on metals bioavailability evaluates possible binding of metals by both AVS and organic matter and provides the following scale to evaluate whether or not the organic carbon binding phase (represented as fraction organic carbon or foc), in conjunction with the AVS, is affecting the bioavailability of divalent metals in sediments:

If the (∑SEM-AVS)/foc exceeds 3000 µmol/goc, the sediments are presumed to be "likely to be toxic";
If the (∑SEM-AVS)/foc is between 130 and 3,000 µmol/goc, predictions of effects are uncertain; and
If the (∑SEM-AVS)/foc is less than 130 µmol/goc, the sediments are presumed to "not likely" be toxic.

**Table 4-3**
**Evaluation of SEM, AVS, and TOC**

| | | Background Locations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Location | | SEDBACK1600N | | SEDBACK1700N | | SEDBACK1800N | | SEDBACK1900N | | SEDBACK2000N | |
| Sample Date | | 6/12/2017 | | 6/12/2017 | | 6/12/2017 | | 6/13/2017 | | 6/13/2017 | |
| | Unit | | | | | | | | | | |
| TOTAL ORGANIC CARBON | mg/kg | 140000 | | 80000 | J | 29000 | J | 16000 | | 51000 | |
| ACID VOLATILE SULFIDES | umol/g | 5.7 | J | 1.8 | J+ | 1.6 | J- | 1.2 | | 2.4 | |
| CADMIUM | umol/g | 0.0041 | J | 0.0035 | | 0.0025 | | 0.0035 | | 0.0034 | |
| COPPER | umol/g | 0.53 | J | 0.31 | | 0.27 | | 0.36 | | 0.32 | |
| LEAD | umol/g | 0.21 | J | 0.18 | | 0.1 | | 0.15 | | 0.14 | |
| NICKEL | umol/g | 0.43 | J | 0.33 | | 0.22 | | 0.21 | | 0.2 | |
| SILVER | umol/g | R | | R | | R | | < 0.0022 | U | < 0.0024 | U |
| ZINC | umol/g | 2.4 | J | 2 | | 1.4 | | 1.9 | | 1.7 | |
| | | | | | | | | | | | |
| Sum SEM | umol/g | 3.6 | | 2.82 | | 2.0 | | 2.62 | | 2.36 | |
| Sum SEM / AVS | unitless | 0.63 | | **1.57** | | **1.25** | | **2.19** | | 0.98 | |
| Sum SEM - AVS | umol/g | -2.1 | | **1.02** | | **0.39** | | **1.42** | | -0.037 | |
| [Sum SEM - AVS]/goc | umol/$g_{oc}$ | -15 | | 13 | | 14 | | 89 | | -0.72 | |

Notes:
Sum SEM is the sum of detected concentrations only.
J - Estimated concentration (-/+ biased).
mg/kg - milligram/kilogram.
NC - Not calculated due to non-detect AVS value.
R - The analyte of interest may or may not be present at the 95% confidence level and theresult is know to be inaccurate or imprecise.
U - Not detected.
umol/g - micromole per gram
umol/$g_{oc}$ - micromole per gram organic carbon
**Bold text indicates Sum SEM / AVS is greater than 1 or Sum SEM - AVS is greater than 0.**

USEPA (2005) guidance on metals bioavailability evaluates possible binding of metals by both AVS and organic matter and provides the following scale to evaluate whether or not the organic carbon binding phase (represented as fraction organic carbon or $f_{oc}$), in conjunction with the AVS, is affecting the bioavailability of divalent metals in sediments:

If the (∑SEM-AVS)/$f_{oc}$ exceeds 3000 µmol/$g_{oc}$, the sediments are presumed to be "likely to be toxic";
If the (∑SEM-AVS)/$f_{oc}$ is between 130 and 3,000 µmol/$g_{oc}$, predictions of effects are uncertain; and
If the (∑SEM-AVS)/$f_{oc}$ is less than 130 µmol/$g_{oc}$, the sediments are presumed to "not likely" be toxic.

**Table 4-4**
**Sediment Toxicity Test Results - Amphipod**

**Amphipod (*H. azteca* ) test**

| Location ID | Location Description | Mean 10 Day Survival (%) | | | | | | | Mean Weight Growth (mg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lab Control A [*] | -- | 95.0 | | | | | | | 0.16 | | | | | | |
| SEDBACK16 [a] | Background | 83.8 | * | | | | | | 0.11 | * | | | | | |
| SEDBACK17 [b] | Background | 96.3 | | | | | | | 0.15 | | | | | | |
| SEDBACK18 [c] | Background | 97.5 | | | | | | | 0.15 | | | | | | |
| SEDBACK19 [d] | Background | 97.5 | | | | | | | 0.14 | | | | | | |
| SEDBACK20 [e] | Background | 91.3 | | | | | | | 0.15 | | | | | | |
| SED6.5D | Cove | 95.0 | | | | | | | 0.15 | | | | | | |
| SED6.5E | Cove | 96.3 | | | | | | | 0.15 | | | | | | |
| SED7.5D | Cove | 96.3 | | | | | | | **0.14** | * | | | | | e |
| SED7.5E | Cove | 98.8 | | | | | | | **0.14** | * | | | | | e |
| SED7D | Cove | 93.8 | | | | | | | 0.15 | | | | | | |
| SED7E | Cove | 93.8 | | | | | | | **0.13** | * | | | | | e |
| SED7F | Cove | 96.3 | | | | | | | **0.14** | * | | | | | |
| SED6A | Channel | 95.0 | | | | | | | **0.13** | * | | | | | e |
| SED6B | Channel | 93.8 | | | | | | | 0.15 | | | | | | |
| SED6C | Channel | 96.3 | | | | | | | **0.14** | * | | | | | |
| SED7A | Channel | 93.8 | | | | | | | 0.14 | | | | | | |
| SED7B | Channel | **90.0** | | | | c | d | | **0.13** | * | | b | c | | e |
| SED8A | Channel | 98.8 | | | | | | | **0.13** | * | | | | | e |
| SED8B | Channel | 96.3 | | | | | | | **0.14** | | | | | | |
| SED8C | Channel | 97.5 | | | | | | | **0.14** | * | | | | | e |
| Minimum Background Sample Response [f] | | 91.3 | % | | | | | | 0.14 | mg | | | | | |

Test acceptabilty criteria
>80% survival

* - Statistically significant reduction (p<0.05) relative to group-specific lab control.
a - Statistically significant reduction (p<0.05) relative to SEDBACK1600N.
b - Statistically significant reduction (p<0.05) relative to SEDBACK1700N.
c - Statistically significant reduction (p<0.05) relative to SEDBACK1800N.
d - Statistically significant reduction (p<0.05) relative to SEDBACK1900N.
e - Statistically significant reduction (p<0.05) relative to SEDBACK2000N.
**Boldface indicates Site result below minimum background sample response.**
[f] The results of background sample SEDBACK16 are the lowest Background sample response. However, because this background sample is statistically different from the lab control for both survival and growth endpoints, the next lowest background response per endpoint was selected for comparison with Site samples.

**Table 4-5**
**Sediment Toxicity Test Results - Midge**

**Midge (*C. dilutus*) test**

| Location ID | Location Description | Mean 10 Day Survival (%) | | | | | | | Mean Ash-Free Dry Weight (mg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lab Control A [*] | -- | 91.3 | | | | | | | 1.89 | | | | | | |
| SEDBACK16 [a] | Background | 83.8 | * | | | | | | 2.37 | | | | | | |
| SEDBACK17 [b] | Background | 90.0 | | | | | | | 1.80 | | | | | | |
| SEDBACK18 [c] | Background | 86.3 | | | | | | | 2.05 | | | | | | |
| SEDBACK19 [d] | Background | 90.0 | | | | | | | 1.92 | | | | | | |
| SEDBACK20 [e] | Background | 85.0 | | | | | | | 2.09 | | | | | | |
| SED6.5D | Cove | **82.5** | * | | | | | | **1.79** | | a | | c | | e |
| SED6.5E | Cove | 90.0 | | | | | | | 1.90 | | a | | | | e |
| SED7.5D | Cove | 87.5 | | | | | | | **1.72** | | a | | c | | e |
| SED7.5E | Cove | 92.5 | | | | | | | **1.64** | * | a | b | c | d | e |
| SED7D | Cove | 88.8 | | | | | | | 1.88 | | a | | | | e |
| SED7E | Cove | 93.8 | | | | | | | **1.79** | | a | | c | | e |
| SED7F | Cove | 87.5 | | | | | | | 1.87 | | a | | | | e |
| SED6A | Channel | 87.5 | | | | | | | 1.93 | | a | | | | |
| SED6B | Channel | 92.5 | | | | | | | 1.84 | | a | | | | e |
| SED6C | Channel | 91.3 | | | | | | | **1.74** | | a | | c | | e |
| SED7A | Channel | 87.5 | | | | | | | 1.87 | | a | | | | e |
| SED7B | Channel | 88.8 | | | | | | | **1.41** | * | a | b | c | d | e |
| SED8A | Channel | 85.0 | | | | | | | 1.96 | | a | | | | |
| SED8B | Channel | 88.8 | | | | | | | 1.88 | | a | | | | e |
| SED8C | Channel | 85.0 | | | | | | | **1.73** | | a | | c | | e |
| Minimum Background Sample Response | | 85.0 | % [f] | | | | | | 1.80 | mg | | | | | |

Test acceptabilty criteria
>70% survival
>0.48 mg Ash-Free Dry Weight (AFDW)
* - Statistically significant reduction ($p<0.05$) relative to group-specific lab control.
a - Statistically significant reduction ($p<0.05$) relative to SEDBACK1600N.
b - Statistically significant reduction ($p<0.05$) relative to SEDBACK1700N.
c - Statistically significant reduction ($p<0.05$) relative to SEDBACK1800N.
d - Statistically significant reduction ($p<0.05$) relative to SEDBACK1900N.
e - Statistically significant reduction ($p<0.05$) relative to SEDBACK2000N.
**Boldface indicates Site result below minimum background sample response.**
[f] The results of background sample SEDBACK16 are the lowest background sample response for survival. Because this background sample is statistically different from the lab control for the survival endpoint, the next lowest background response was selected for comparison with Site samples.

**Table 4-6**
**ARSP Sediment Toxicity Test Results - Midge**

| | | *C. dilutus* 10-day Survival and Growth/BiomassResults | | | | | |
|---|---|---|---|---|---|---|---|
| **Location** | **Associated Laboratory Control** | **Mean Survival (%)** | | **Growth - Mean Weight of Survivors (mg)** | | **Biomass - Mean Individual Weight based on 10 Organisms per Chamber (mg)** | |
| **Test Sediment Results** | | | | | | | |
| RI-R6-23-TX | 2015 Batch D | 87.5 | | 1.4 | X | 1.2 | X |
| RI-R6-22-TX | 2015 Batch D | 87.5 | | 1.5 | X | 1.3 | X |
| RI-R6-21-TX | 2015 Batch A | 76.3 | X | 1.3 | X | 1.0 | X |
| RI-R6-18-TX | 2015 Batch D | 77.5 | X | 1.3 | X | 1.0 | X |
| RI-R5-06-TX | 2015 Batch D | 92.5 | | 3.4 | | 3.1 | |
| RI-R5-04-TX | 2014 Batch C | 66.3 | X | 2.7 | | 1.8 | |
| **Lab Control Results** | | | | | | | |
| 2014 Batch C Control | -- | 85.0 | | 2.2 | | 1.9 | |
| 2015 Batch A Control | -- | 93.4 | | 2.2 | | 2.1 | |
| 2015 Batch D Control | -- | 96.3 | | 2.8 | | 2.7 | |

X - Indicates test sediment response was significantly lower than the corresponding control response (per Appendix D of the Anacostia River Sediment Project Remedial Investigation Report (Tetra Tech, 2018)).
SV - Survival.
GR - Growth/Biomass.

Table 4-7

ARSP Sediment Toxicity Test Results - Amphipod

| | | *H. azteca* Survival, Growth/Biomass, and Reproduction Results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Survival | | | | Growth/Biomass | | | | Reproduction |
| Location | Associated Laboratory Control | 28-Day Mean Survival (%) (n = 12) | 28-Day Mean Survival (%) (n = 8) | 35-Day Mean Survival (%) (n = 8) | 42-Day Mean Survival (%) (n = 8) | Growth - 28-Day Mean Weight of Survivors (mg) | Biomass - 28-Day Mean Individual Weight based on 10 Organisms per Chamber (mg) | Growth - 42-Day Mean Weight of Survivors (mg) | Biomass - 42-Day Mean Individual Weight based on 10 Organisms per Chamber (mg) | 42-Day Average Young/ Female |
| **Test Sediment Results** | | | | | | | | | | |
| RI-R6-23-TX | 2015 Batch D | 83.3 | 78.8 | 75.0 | 73.8 X | 0.30 | 0.28 | 0.46 | 0.34 X | 2.3 X |
| RI-R6-22-TX | 2015 Batch D | 94.2 | 95.0 | 92.5 | 93.8 | 0.22 | 0.20 X | 0.42 | 0.40 | 1.2 X |
| RI-R6-21-TX | 2015 Batch C | 90.0 | 91.3 | 83.8 | 83.8 | 0.37 | 0.33 | 0.36 | 0.30 X | 3.8 |
| RI-R6-18-TX | 2015 Batch D | 90.0 | 90.0 | 85.0 | 85.0 | 0.31 | 0.28 | 0.36 | 0.31 X | 4.6 |
| RI-R5-06-TX | 2015 Batch D | 95.8 | 95.0 | 91.3 | 90.0 | 0.37 | 0.36 | 0.52 | 0.47 | 7.6 |
| RI-R5-04-TX | 2014 Batch D | 96.7 | 96.3 | 90.0 | 90.0 | 0.62 | 0.60 | 0.77 | 0.69 | 6.8 |
| **Lab Control Results** | | | | | | | | | | |
| 2014 Batch D Control | -- | 95.0 | 93.8 | 93.8 | 90.0 | 0.51 | 0.49 | 0.77 | 0.69 | 8.0 |
| 2015 Batch C Control | -- | 90.0 | 91.3 | 92.5 | 90.0 | 0.29 | 0.26 | 0.49 | 0.44 | 6.0 |
| 2015 Batch D Control | -- | 93.3 | 93.8 | 91.3 | 91.3 | 0.31 | 0.29 | 0.45 | 0.41 | 6.2 |

X - Indicates test sediment response was significantly lower than the corresponding control response (per Appendix D of the Anacostia River Sediment Project Remedial Investigation Report (Tetra Tech, 2018)).
Statistical significance was reported for 28-day mean survival, but it was not stated whether than was based on n=12 or n=8 results.
SV - Survival.
GR - Growth/Biomass.
REP - Reproduction.

**Table 4-8**
**B-IBI scores of Benthic Macroinvertebrate Community Measured in Site and Reference Samples**

| Sampling Location | B-IBI Score | | Chesapeake Bay B-IBI Category (a) |
|---|---|---|---|
| | Mean | Standard Deviation | |
| Background | | | |
| SEDBACK16 | 2.67 | 0.29 | Marginal |
| SEDBACK17 | 1.67 | 0.58 | Severely Degraded |
| SEDBACK18 | 1.83 | 0.76 | Severely Degraded |
| SEDBACK19 | 2.17 | 1.04 | Degraded |
| SEDBACK20 | 1.83 | 0.29 | Severely Degraded |
| Mean Background | 2.03 | | Degraded |
| Site | | | |
| SED6.5D | **3.00** | 0.00 | Meets Goal |
| SED6.5E | 2.83 | 0.29 | Marginal |
| SED6A | 2.33 | 0.29 | Degraded |
| SED6B | 2.83 | 0.58 | Marginal |
| SED6C | 2.67 | 0.58 | Marginal |
| SED7.5D | **3.17** | 0.29 | Meets Goal |
| SED7.5E | **3.00** | 0.50 | Meets Goal |
| SED7A | **3.17** | 0.76 | Meets Goal |
| SED7B | 2.83 | 0.29 | Marginal |
| SED7D | **3.00** | 0.00 | Meets Goal |
| SED7E | 2.67 | 0.29 | Marginal |
| SED7F | 2.33 | 0.76 | Degraded |
| SED8A | 2.33 | 1.04 | Degraded |
| SED8B | **3.50** | 0.00 | Meets Goal |
| SED8C | 1.83 | 0.29 | Severely Degraded |
| Mean Site | 2.77 | | Marginal |

Notes:
B-IBI - Benthic Index of Biotic Integrity
(a) B-IBI values are categorized by the Chesapeake Bay Monitoring Program Benthic Community Restoration Goals (VERSAR, Inc., 2002).
B-IBI values greater than 3 (in bold) meet restoration goals, values between 2.7 and 2.9 are considered "marginal", values between 2.1 and 2.6 are "degraded", and values less than 2 are considered "severely degraded".

## Table 4-9
## Surface Water Ecological Screening Values

| Detected Chemical | Chronic ESV (a) | | Chronic ESV Source | Acute ESV (b) | Acute ESV Source |
|---|---|---|---|---|---|
| **INORGANICS - DISSOLVED PHASE** | | | | | |
| Arsenic | 150 | | DOH, 2014 | NCOPC | |
| Barium | 4 | | USEPA, 2006 | 110 | Suter and Tsao, 1996 |
| Calcium | 116000 | | USEPA, 2006 | NCOPC | |
| Chromium | 11.0 | (d) | DOH, 2014 | NCOPC | |
| Cobalt | 23 | | USEPA, 2006 | NCOPC | |
| Iron | 1000 | | DOH, 2014 | NV | |
| Magnesium | 82000 | | USEPA, 2006 | NCOPC | |
| Manganese | 120 | | USEPA, 2006 | 2300 | Suter and Tsao, 1996 |
| Nickel | 128.0 | (c) | DOH, 2014 | NCOPC | |
| Potassium | 53000 | | USEPA, 2006 | NCOPC | |
| Sodium | 680000 | | USEPA, 2006 | NCOPC | |
| Vanadium | 20 | | USEPA, 2006 | NCOPC | |
| Zinc | 291 | (c) | DOH, 2014 | NCOPC | |
| **INORGANICS - TOTAL RECOVERABLE PHASE** | | | | | |
| Aluminum | 87 | | USEPA, 2006 | 750 | Suter and Tsao, 1996 |
| Antimony | 30 | | Suter and Tsao, 1996 | 180 | Suter and Tsao, 1996 |
| Cadmium | 0.60 | (c) | DOH, 2014 | NCOPC | |
| Copper | 23.2 | (c) | DOH, 2014 | NCOPC | |
| Iron | 300 | | USEPA, 2006 | NV | |
| Lead | 12.3 | (c) | DOH, 2014 | NCOPC | |
| Nickel | 128 | (c) | DOH, 2014 | NCOPC | |
| Zinc | 295 | (c) | DOH, 2014 | NCOPC | |
| **POLYCHLORINATED BIPHENYLs** | | | | | |
| Total PCBs | 0.014 | | DOH, 2014 | NCOPC | |
| **SEMI-VOLATILE ORGANIC COMPOUNDS** | | | | | |
| Acenaphthene | 50 | | DOH, 2014 | NCOPC | |
| Fluoranthene | 400 | | DOH, 2014 | NCOPC | |
| Fluorene | 3 | | USEPA, 2006 | NCOPC | |
| Naphthalene | 600 | | DOH, 2014 | NCOPC | |
| Phenanthrene | 0.4 | | USEPA, 2006 | NCOPC | |
| Pyrene | 0.025 | | USEPA, 2006 | NV | |

**Notes:**
All units are in micrograms per liter (μg/L).
Acute ESV - Acute Ecological Screening Value.
Chronic ESV - Chronic Ecological Screening Value.
COPC - Chemical of Potential Concern.
NCOPC - Not identified as a COPC following the screen comparing chronic ESVs to maximum detected concentrations.
NV - No value.
ESVs are presented for detected chemicals only in surface water and groundwater.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DDOE WQS Criteria (DOH, 2014), USEPA Region 3 freshwater screening values (USEPA, 2006), and literature values (Suter and Tsao, 1996; Buchman, 2008).
(b) Acute ESVs selected based on freshwater acute criteria available from DDOE (DOH, 2014), Suter and Tsao (1996), and Buchman (2008).
(c) Hardness dependent criteria. Value presented has been adjusted by a mean hardness of 290 mg/L as $CaCO_3$ for the Waterside Investigation Area.
(d) Value for Hexavalant Chromium used.

**Table 4-10**
**Identification of Pore Water COPCs**

| Detected Analyte | FOD | Detected Concentrations Minimum | Mean | Maximum | Chronic ESV (a) | COPC Determination and Rationale |
|---|---|---|---|---|---|---|
| **INORGANICS - DISSOLVED** | | | | | | |
| Arsenic | 14 : 15 | 1.1 | 1.7 | 3.3 | 150 | No - Max detect < ESV |
| Barium | 15 : 15 | 74 | 110 | 180 | 4 | Yes - Max detect > ESV |
| Calcium | 15 : 15 | 51000 | 83000 | 150000 | 116000 | EN |
| Chromium | 13 : 15 | 0.38 | 0.51 | 0.99 | 11 | No - Max detect < ESV |
| Cobalt | 15 : 15 | 0.30 | 6.2 | 19 | 23 | No - Max detect < ESV |
| Iron | 15 : 15 | 4400 | 19000 | 67000 | 1000 | Yes - Max detect > ESV |
| Magnesium | 15 : 15 | 14000 | 20000 | 35000 | 82000 | EN |
| Manganese | 15 : 15 | 1300 | 4300 | 11000 | 120 | Yes - Max detect > ESV |
| Nickel | 15 : 15 | 0.89 | 1.9 | 3.8 | 128 (b) | No - Max detect < ESV |
| Potassium | 15 : 15 | 5300 | 6800 | 10000 | 53000 | EN |
| Sodium | 15 : 15 | 42000 | 50000 | 57000 | 680000 | EN |
| Vanadium | 8 : 15 | 0.60 | 0.70 | 0.92 | 20 | No - Max detect < ESV |
| Zinc | 8 : 15 | 2.9 | 3.7 | 6.4 | 291 (b) | No - Max detect < ESV |
| **INORGANICS - TOTAL** | | | | | | |
| Aluminum | 15 : 15 | 28 | 100 | 360 | 87 | Yes - Max detect > ESV |
| Antimony | 1 : 15 | 3.3 | 3.3 | 3.3 | 30 | No - Max detect < ESV |
| Arsenic | 15 : 15 | 1.6 | 4.4 | 7.1 | 150 | No - Max detect < ESV |
| Barium | 15 : 15 | 96 | 170 | 340 | 4 | Yes - Max detect > ESV |
| Cadmium | 2 : 15 | 0.10 | 0.11 | 0.11 | 0.60 (b) | No - Max detect < ESV |
| Calcium | 15 : 15 | 52000 | 83000 | 160000 | NV | EN |
| Chromium | 15 : 15 | 0.51 | 1.3 | 5.4 | 11 | No - Max detect < ESV |
| Cobalt | 15 : 15 | 0.44 | 7.3 | 23 | 1500 | No - Max detect < ESV |
| Copper | 15 : 15 | 1.1 | 3.0 | 6.5 | 23 (b) | No - Max detect < ESV |
| Iron | 15 : 15 | 13000 | 44000 | 110000 | 300 | Yes - Max detect > ESV |
| Lead | 15 : 15 | 0.50 | 2.7 | 7.1 | 12 (b) | No - Max detect < ESV |
| Magnesium | 15 : 15 | 14000 | 20000 | 35000 | NV | EN |
| Manganese | 15 : 15 | 1300 | 4600 | 13000 | 120 | Yes - Max detect > ESV |
| Nickel | 15 : 15 | 1.4 | 2.7 | 4.8 | 128 (b) | No - Max detect < ESV |
| Potassium | 15 : 15 | 5200 | 6900 | 11000 | NV | EN |
| Sodium | 15 : 15 | 41000 | 49000 | 58000 | NV | EN |
| Vanadium | 15 : 15 | 0.97 | 2.2 | 5.2 | 20 | No - Max detect < ESV |
| Zinc | 14 : 15 | 3.9 | 7.6 | 13 | 295 (b) | No - Max detect < ESV |
| **POLYCHLORINATED BIPHENYLS (PCBs) - DISSOLVED** | | | | | | |
| PCB, TOTAL | 15 : 15 | 0.0016 | 0.0038 | 0.01 | 0.014 | No - Max detect < ESV |
| **SEMI-VOLATILE ORGANIC COMPOUNDS - DISSOLVED** | | | | | | |
| Acenaphthene | 1 : 15 | 0.15 | 0.15 | 0.15 | 50 | No - Max detect < ESV |
| Fluoranthene | 15 : 15 | 0.010 | 0.03 | 0.09 | 400 | No - Max detect < ESV |
| Fluorene | 1 : 15 | 0.13 | 0.13 | 0.13 | 3 | No - Max detect < ESV |
| Naphthalene | 13 : 15 | 0.10 | 0.13 | 0.22 | 600 | No - Max detect < ESV |
| Phenanthrene | 1 : 15 | 0.31 | 0.31 | 0.31 | 0.40 | No - Max detect < ESV |
| Pyrene | 15 : 15 | 0.02 | 0.031 | 0.12 | 0.025 | Yes - Max detect > ESV |

Notes:
All units are in micrograms per liter (μg/L).
Hazard quotient is calculated by dividing the maximum detected concentration by the ESV.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
EN - Essential Nutrient.
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
NC - Not Calculated.
NCOPC - Not a COPC.
PAH - Polycyclic Aromatic Hydrocarbon.
USEPA - United States Environmental Protection Agency.
WQS - Water Quality Standards.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DOEE WQS (DOEE, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and other literature values (Suter and Tsao 1996, Buchman 2008). See Table 3-2 for surfacewater ecological screening levels.
(b) Value presented has been adjusted by a hardness of 290 mg/L as $CaCO_3$ for the Waterside Investigation Area.

**Table 4-11**

**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Reference Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Location** | SEDBACK16 | | SEDBACK17 | | SEDBACK18 | | SEDBACK19 | | SEDBACK20 | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Total Organic Carbon | mg/kg | 140000 | J | 80000 | J | 29000 | J | 16000 | J | 51000 | J |
| Acenaphthene | mg/kg | 0.076 | J | 0.028 | | 0.011 | | 0.019 | J | 0.011 | |
| Acenaphthylene | mg/kg | 0.019 | J | 0.013 | J | 0.008 | | 0.0058 | | 0.0074 | |
| Anthracene | mg/kg | 0.26 | J | 0.09 | J- | 0.029 | | 0.05 | J | 0.028 | |
| Benzo(a)anthracene | mg/kg | 1.6 | J | 1 | | 0.32 | | 0.29 | J | 0.27 | |
| Benzo(a)pyrene | mg/kg | 1.5 | J | 1 | | 0.38 | | 0.31 | J | 0.32 | |
| Benzo(b)fluoranthene | mg/kg | 2.4 | J | 1.8 | | 0.68 | | 0.57 | J | 0.56 | |
| Benzo(e)pyrene | mg/kg | 1.4 | J | 0.98 | | 0.39 | | 0.31 | J | 0.31 | |
| Benzo(g,h,i)perylene | mg/kg | 1.4 | J | 1 | | 0.45 | | 0.34 | J | 0.33 | |
| Benzo(k)fluoranthene | mg/kg | 1.3 | J | 0.83 | | 0.3 | | 0.27 | J | 0.25 | |
| C1-Benzanthracene/chrysenes | mg/kg | 1.1 | JN | 0.69 | JN | 0.28 | JN | 0.24 | JN | 0.23 | JN |
| C1-Fluorenes | mg/kg | 0.091 | JN | 0.041 | JN | 0.017 | JN | 0.017 | JN | 0.012 | JN |
| C1-Naphthalenes | mg/kg | 0.031 | J | 0.14 | U | 0.0078 | J | 0.0139 | J | | |
| C1-Phenanthrene/anthracenes | mg/kg | 0.44 | JN | 0.19 | JN | 0.081 | JN | 0.071 | JN | 0.059 | JN |
| C1-Pyrene/fluoranthenes | mg/kg | 1.2 | JN | 0.66 | JN | 0.28 | JN | 0.22 | JN | 0.22 | JN |
| C2-Benzanthracene/chrysenes | mg/kg | 0.55 | JN | 0.36 | JN | 0.15 | JN | 0.13 | JN | 0.13 | JN |
| C2-Fluorenes | mg/kg | 0.12 | JN | 0.056 | JN | 0.027 | JN | 0.027 | JN | 0.021 | JN |
| C2-Naphthalenes | mg/kg | 0.065 | JN | 0.031 | JN | 0.016 | JN | 0.017 | JN | 0.011 | JN |
| C2-Phenanthrene/anthracenes | mg/kg | 0.51 | JN | 0.25 | JN | 0.11 | JN | 0.11 | JN | 0.082 | JN |
| C3-Benzanthracene/chrysenes | mg/kg | 0.29 | JN | 0.19 | JN | 0.086 | JN | 0.07 | JN | 0.071 | JN |
| C3-Fluorenes | mg/kg | 0.12 | JN | 0.069 | JN | 0.032 | JN | 0.035 | JN | 0.028 | JN |
| C3-Naphthalenes | mg/kg | 0.084 | JN | 0.042 | JN | 0.021 | JN | 0.029 | JN | 0.015 | JN |
| C3-Phenanthrene/anthracenes | mg/kg | 0.29 | JN | 0.16 | JN | 0.086 | JN | 0.072 | JN | 0.051 | JN |
| C4-Benzanthracene/chrysenes | mg/kg | 0.15 | JN | 0.11 | JN | 0.045 | JN | 0.035 | JN | 0.043 | JN |
| C4-Naphthalenes | mg/kg | 0.083 | JN | 0.05 | JN | 0.021 | JN | 0.029 | JN | 0.017 | JN |
| C4-Phenanthrenes/anthracenes | mg/kg | 0.13 | JN | 0.084 | JN | 0.072 | JN | 0.043 | JN | 0.032 | JN |
| Chrysene | mg/kg | 2.2 | J | 1.5 | | 0.58 | | 0.47 | J | 0.52 | |
| Dibenzo(a,h)anthracene | mg/kg | 0.26 | J | 0.17 | | 0.07 | | 0.059 | J | 0.061 | |
| Fluoranthene | mg/kg | 3.5 | J | 2 | | 0.79 | | 0.68 | J | 0.63 | |
| Fluorene | mg/kg | 0.14 | J | 0.047 | | 0.02 | | 0.021 | J | 0.015 | |
| Indeno(1,2,3-cd)pyrene | mg/kg | 1.1 | J | 0.79 | | 0.31 | | 0.26 | J | 0.26 | |
| Naphthalene | mg/kg | <0.37 | UJ | < 0.29 | U | < 0.1 | U | < 0.099 | U | < 0.1 | U |
| Perylene | mg/kg | 0.43 | J | 0.31 | | 0.13 | | 0.12 | J | 0.11 | |
| Phenanthrene | mg/kg | 1.7 | J | 0.76 | | 0.3 | | 0.31 | J | 0.23 | |
| Pyrene | mg/kg | 2.9 | J | 1.7 | | 0.67 | | 0.54 | J | 0.53 | |
| Total $PAH_{34}$ | mg/kg | 27.4 | | 17.1 | | 6.8 | | 5.8 | | 5.5 | |
| **Toxic Unit Calculation** | $C_{OC,PAHi,FCVi}$ | | | | | | | | | | |
| Acenaphthene | 491 | 0.0011 | | 0.0007 | | 0.0008 | | 0.0024 | | 0.0004 | |
| Acenaphthylene | 452 | 0.0003 | | 0.0004 | | 0.0006 | | 0.0008 | | 0.0003 | |
| Anthracene | 594 | 0.0031 | | 0.0019 | | 0.0017 | | 0.0053 | | 0.0009 | |
| Benzo(a)anthracene | 841 | 0.0136 | | 0.0149 | | 0.0131 | | 0.0216 | | 0.0063 | |
| Benzo(a)pyrene | 965 | 0.0111 | | 0.0130 | | 0.0136 | | 0.0201 | | 0.0065 | |
| Benzo(b)fluoranthene | 979 | 0.0175 | | 0.0230 | | 0.0240 | | 0.0364 | | 0.0112 | |
| Benzo(e)pyrene | 967 | 0.0103 | | 0.0127 | | 0.0139 | | 0.0200 | | 0.0063 | |
| Benzo(g,h,i)perylene | 648 | 0.0154 | | 0.0193 | | 0.0239 | | 0.0328 | | 0.0100 | |
| Benzo(k)fluoranthene | 981 | 0.0095 | | 0.0106 | | 0.0105 | | 0.0172 | | 0.0050 | |
| C1-Benzanthracene/chrysenes | 929 | 0.0085 | | 0.0093 | | 0.0104 | | 0.0161 | | 0.0049 | |
| C1-Fluorenes | 611 | 0.0011 | | 0.0008 | | 0.0010 | | 0.0017 | | 0.0004 | |
| C1-Naphthalenes | 444 | 0.0005 | | 0.0039 | | 0.0006 | | 0.0020 | | 0.0000 | |
| C1-Phenanthrene/anthracenes | 670 | 0.0047 | | 0.0035 | | 0.0042 | | 0.0066 | | 0.0017 | |
| C1-Pyrene/fluoranthenes | 770 | 0.0111 | | 0.0107 | | 0.0125 | | 0.0179 | | 0.0056 | |
| C2-Benzanthracene/chrysenes | 1008 | 0.0039 | | 0.0045 | | 0.0051 | | 0.0081 | | 0.0025 | |
| C2-Fluorenes | 686 | 0.0012 | | 0.0010 | | 0.0014 | | 0.0025 | | 0.0006 | |
| C2-Naphthalenes | 510 | 0.0009 | | 0.0008 | | 0.0011 | | 0.0021 | | 0.0004 | |
| C2-Phenanthrene/anthracenes | 746 | 0.0049 | | 0.0042 | | 0.0051 | | 0.0092 | | 0.0022 | |
| C3-Benzanthracene/chrysenes | 1112 | 0.0019 | | 0.0021 | | 0.0027 | | 0.0039 | | 0.0013 | |
| C3-Fluorenes | 769 | 0.0011 | | 0.0011 | | 0.0014 | | 0.0028 | | 0.0007 | |
| C3-Naphthalenes | 581 | 0.0010 | | 0.0009 | | 0.0012 | | 0.0031 | | 0.0005 | |
| C3-Phenanthrene/anthracenes | 829 | 0.0025 | | 0.0024 | | 0.0036 | | 0.0054 | | 0.0012 | |
| C4-Benzanthracene/chrysenes | 1214 | 0.0009 | | 0.0011 | | 0.0013 | | 0.0018 | | 0.0007 | |
| C4-Naphthalenes | 657 | 0.0009 | | 0.0010 | | 0.0011 | | 0.0028 | | 0.0005 | |
| C4-Phenanthrenes/anthracenes | 913 | 0.0010 | | 0.0012 | | 0.0027 | | 0.0029 | | 0.0007 | |

**Table 4-11**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Reference Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Location** | SEDBACK16 | | SEDBACK17 | | SEDBACK18 | | SEDBACK19 | | SEDBACK20 | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Chrysene | 826 | 0.0190 | | 0.0227 | | 0.0242 | | 0.0356 | | 0.0123 | |
| Dibenzo(a,h)anthracene | 1123 | 0.0017 | | 0.0019 | | 0.0021 | | 0.0033 | | 0.0011 | |
| Fluoranthene | 707 | 0.0354 | | 0.0354 | | 0.0385 | | 0.0601 | | 0.0175 | |
| Fluorene | 538 | 0.0019 | | 0.0011 | | 0.0013 | | 0.0024 | | 0.0005 | |
| Indeno(1,2,3-cd)pyrene | 1115 | 0.0070 | | 0.0089 | | 0.0096 | | 0.0146 | | 0.0046 | |
| Naphthalene | 385 | NC | | NC | | NC | | NC | | NC | |
| Perylene | 967 | 0.0032 | | 0.0040 | | 0.0046 | | 0.0078 | | 0.0022 | |
| Phenanthrene | 596 | 0.0204 | | 0.0159 | | 0.0174 | | 0.0325 | | 0.0076 | |
| Pyrene | 697 | 0.0297 | | 0.0305 | | 0.0331 | | 0.0484 | | 0.0149 | |
| **ΣESBTU (a)** | | 0.25 | | 0.27 | | 0.29 | | 0.45 | | 0.13 | |

Notes:
< - Result not detected above laboratory reporting limit.
mg/kg - milligrams per kilogram.
ΣESBTU - Sum of the toxic units within a sample. Calculated as OC normalized sediment concentration divided by OC normalized equilibrium partitioning (EqP) sediment criterion corresponding to pore water FCV for each PAH.
ESB - Equilibrium Partitioning Sediment Benchmark.

FCV - Sediment Final Chronic Value, in organic carbon normalized units (USEPA, 2003).
J - The concentration value is estimated.
JN - The analyte was tentatively identified; the associated numerical value is an estimated quantity with an unknown bias.
NC - Not calculated.
OC - organic carbon.
$PAH_{34}$ - Polycyclic Aromatic Hydrocarbons including alkylated PAHs.
U - The target analyte was not detected above the reporting detection limit. Not included in TU calculation.
$C_{OC,PAHi,FCVi}$ - Sediment Final Chronic Value, in organic carbon normalized units for each PAH (USEPA, 2003).

(a) ΣESBTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in bold.

**Table 4-11**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Site Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Location** | SED6.5D | | SED6.5E | | SED6A | | SED6B | | SED6C | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Total Organic Carbon | mg/kg | 65000 | J | 70000 | | 83000 | | 21000 | | 96000 | |
| Acenaphthene | mg/kg | 0.033 | | 0.047 | | 0.026 | | 0.02 | | 0.024 | |
| Acenaphthylene | mg/kg | 0.019 | | 0.023 | | 0.024 | | 0.021 | | 0.025 | |
| Anthracene | mg/kg | 0.076 | | 0.093 | | 0.12 | | 0.08 | | 0.064 | |
| Benzo(a)anthracene | mg/kg | 0.65 | | 0.73 | | 0.91 | | 0.74 | | 0.61 | |
| Benzo(a)pyrene | mg/kg | 0.67 | | 0.83 | | 0.89 | | 0.85 | | 0.72 | |
| Benzo(b)fluoranthene | mg/kg | 1.1 | | 1.5 | | 1.7 | | 1.3 | | 1.5 | |
| Benzo(e)pyrene | mg/kg | 0.66 | | 0.78 | | 0.89 | | 0.7 | | 0.74 | |
| Benzo(g,h,i)perylene | mg/kg | 0.64 | | 0.81 | | 0.91 | | 0.8 | | 0.83 | |
| Benzo(k)fluoranthene | mg/kg | 0.51 | | 0.59 | | 0.59 | | 0.6 | | 0.49 | |
| C1-Benzanthracene/chrysenes | mg/kg | 0.73 | JN | 0.98 | JN | 0.75 | JN | 0.45 | JN | 0.68 | JN |
| C1-Fluorenes | mg/kg | 0.1 | JN | 0.21 | JN | 0.052 | JN | 0.036 | JN | 0.056 | JN |
| C1-Naphthalenes | mg/kg | 0.136 | | 0.199 | | 0.02 | | 0.214 | | 0.068 | |
| C1-Phenanthrene/anthracenes | mg/kg | 0.2 | JN | 0.31 | JN | 0.16 | JN | 0.13 | JN | 0.16 | JN |
| C1-Pyrene/fluoranthenes | mg/kg | 0.51 | JN | 0.76 | JN | 0.65 | JN | 0.5 | JN | 0.58 | JN |
| C2-Benzanthracene/chrysenes | mg/kg | 0.66 | JN | 0.91 | JN | 0.4 | JN | 0.23 | JN | 0.44 | JN |
| C2-Fluorenes | mg/kg | 0.19 | JN | 0.49 | JN | 0.078 | JN | 0.058 | JN | 0.12 | JN |
| C2-Naphthalenes | mg/kg | 0.16 | JN | 0.25 | JN | 0.05 | JN | 0.13 | JN | 0.082 | JN |
| C2-Phenanthrene/anthracenes | mg/kg | 0.45 | JN | 1 | JN | 0.24 | JN | 0.19 | JN | 0.33 | JN |
| C3-Benzanthracene/chrysenes | mg/kg | 0.49 | JN | 0.66 | JN | 0.22 | JN | 0.12 | JN | 0.22 | JN |
| C3-Fluorenes | mg/kg | 0.27 | JN | 0.62 | JN | 0.1 | JN | 0.078 | JN | 0.16 | JN |
| C3-Naphthalenes | mg/kg | 0.24 | JN | 0.48 | JN | 0.077 | JN | 0.087 | JN | 0.14 | JN |
| C3-Phenanthrene/anthracenes | mg/kg | 0.49 | JN | 1.2 | JN | 0.2 | JN | 0.15 | JN | 0.3 | JN |
| C4-Benzanthracene/chrysenes | mg/kg | 0.26 | JN | 0.41 | JN | 0.12 | JN | 0.066 | JN | 0.14 | JN |
| C4-Naphthalenes | mg/kg | 0.29 | JN | 0.79 | JN | 0.089 | JN | 0.067 | JN | 0.16 | JN |
| C4-Phenanthrenes/anthracenes | mg/kg | 0.33 | JN | 1 | JN | 0.1 | JN | 0.1 | JN | 0.17 | JN |
| Chrysene | mg/kg | 1.1 | | 1.3 | | 1.5 | | 1.1 | | 1.2 | |
| Dibenzo(a,h)anthracene | mg/kg | 0.12 | | 0.15 | | 0.18 | | 0.13 | J | 0.16 | |
| Fluoranthene | mg/kg | 1.3 | | 1.3 | | 1.7 | | 1.4 | | 1.3 | |
| Fluorene | mg/kg | 0.066 | | 0.093 | | 0.04 | | 0.039 | | 0.04 | |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.48 | | 0.63 | | 0.71 | | 0.65 | | 0.63 | |
| Naphthalene | mg/kg | 0.066 | J | 0.078 | J | < 0.29 | U | < 0.19 | U | 0.045 | J |
| Perylene | mg/kg | 0.23 | | 0.29 | | 0.3 | | 0.28 | | 0.31 | |
| Phenanthrene | mg/kg | 0.47 | | 0.59 | | 0.57 | | 0.53 | | 0.45 | |
| Pyrene | mg/kg | 1 | | 1.2 | | 1.7 | | 1.2 | | 1.2 | |
| Total $PAH_{34}$ | mg/kg | 14.7 | | 21.3 | | 16.1 | | 13.0 | | 14.1 | |
| **Toxic Unit Calculation** | $C_{OC,PAHi,FCVi}$ | | | | | | | | | | |
| Acenaphthene | 491 | 0.0010 | | 0.0014 | | 0.0006 | | 0.0019 | | 0.0005 | |
| Acenaphthylene | 452 | 0.0006 | | 0.0007 | | 0.0006 | | 0.0022 | | 0.0006 | |
| Anthracene | 594 | 0.0020 | | 0.0022 | | 0.0024 | | 0.0064 | | 0.0011 | |
| Benzo(a)anthracene | 841 | 0.0119 | | 0.0124 | | 0.0130 | | 0.0419 | | 0.0076 | |
| Benzo(a)pyrene | 965 | 0.0107 | | 0.0123 | | 0.0111 | | 0.0419 | | 0.0078 | |
| Benzo(b)fluoranthene | 979 | 0.0173 | | 0.0219 | | 0.0209 | | 0.0632 | | 0.0160 | |
| Benzo(e)pyrene | 967 | 0.0105 | | 0.0115 | | 0.0111 | | 0.0345 | | 0.0080 | |
| Benzo(g,h,i)perylene | 648 | 0.0152 | | 0.0179 | | 0.0169 | | 0.0588 | | 0.0133 | |
| Benzo(k)fluoranthene | 981 | 0.0080 | | 0.0086 | | 0.0072 | | 0.0291 | | 0.0052 | |
| C1-Benzanthracene/chrysenes | 929 | 0.0121 | | 0.0151 | | 0.0097 | | 0.0231 | | 0.0076 | |
| C1-Fluorenes | 611 | 0.0025 | | 0.0049 | | 0.0010 | | 0.0028 | | 0.0010 | |
| C1-Naphthalenes | 444 | 0.0047 | | 0.0064 | | 0.0005 | | 0.0230 | | 0.0016 | |
| C1-Phenanthrene/anthracenes | 670 | 0.0046 | | 0.0066 | | 0.0029 | | 0.0092 | | 0.0025 | |
| C1-Pyrene/fluoranthenes | 770 | 0.0102 | | 0.0141 | | 0.0102 | | 0.0309 | | 0.0078 | |
| C2-Benzanthracene/chrysenes | 1008 | 0.0101 | | 0.0129 | | 0.0048 | | 0.0109 | | 0.0045 | |
| C2-Fluorenes | 686 | 0.0043 | | 0.0102 | | 0.0014 | | 0.0040 | | 0.0018 | |
| C2-Naphthalenes | 510 | 0.0048 | | 0.0070 | | 0.0012 | | 0.0121 | | 0.0017 | |
| C2-Phenanthrene/anthracenes | 746 | 0.0093 | | 0.0191 | | 0.0039 | | 0.0121 | | 0.0046 | |
| C3-Benzanthracene/chrysenes | 1112 | 0.0068 | | 0.0085 | | 0.0024 | | 0.0051 | | 0.0021 | |
| C3-Fluorenes | 769 | 0.0054 | | 0.0115 | | 0.0016 | | 0.0048 | | 0.0022 | |
| C3-Naphthalenes | 581 | 0.0064 | | 0.0118 | | 0.0016 | | 0.0071 | | 0.0025 | |
| C3-Phenanthrene/anthracenes | 829 | 0.0091 | | 0.0207 | | 0.0029 | | 0.0086 | | 0.0038 | |
| C4-Benzanthracene/chrysenes | 1214 | 0.0033 | | 0.0048 | | 0.0012 | | 0.0026 | | 0.0012 | |
| C4-Naphthalenes | 657 | 0.0068 | | 0.0172 | | 0.0016 | | 0.0049 | | 0.0025 | |
| C4-Phenanthrenes/anthracenes | 913 | 0.0056 | | 0.0156 | | 0.0013 | | 0.0052 | | 0.0019 | |

**Table 4-11**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Site Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Location | SED6.5D | | SED6.5E | | SED6A | | SED6B | | SED6C | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Chrysene | 826 | 0.0205 | | 0.0225 | | 0.0219 | | 0.0634 | | 0.0151 | |
| Dibenzo(a,h)anthracene | 1123 | 0.0016 | | 0.0019 | | 0.0019 | | 0.0055 | | 0.0015 | |
| Fluoranthene | 707 | 0.0283 | | 0.0263 | | 0.0290 | | 0.0943 | | 0.0192 | |
| Fluorene | 538 | 0.0019 | | 0.0025 | | 0.0009 | | 0.0035 | | 0.0008 | |
| Indeno(1,2,3-cd)pyrene | 1115 | 0.0066 | | 0.0081 | | 0.0077 | | 0.0278 | | 0.0059 | |
| Naphthalene | 385 | 0.0026 | | 0.0029 | | NC | | NC | | 0.0012 | |
| Perylene | 967 | 0.0037 | | 0.0043 | | 0.0037 | | 0.0138 | | 0.0033 | |
| Phenanthrene | 596 | 0.0121 | | 0.0141 | | 0.0115 | | 0.0423 | | 0.0079 | |
| Pyrene | 697 | 0.0221 | | 0.0246 | | 0.0294 | | 0.0820 | | 0.0179 | |
| **ΣESBTU (a)** | | 0.28 | | 0.38 | | 0.24 | | 0.78 | | 0.18 | |

Notes:
< - Result not detected above laboratory reporting limit.
mg/kg - milligrams per kilogram.
ΣESBTU - Sum of the toxic units within a sample. Calculated as OC normalized sediment concentration divided by OC normalized equilibrium partitioning (EqP) sediment criterion corresponding to pore water FCV for each PAH.
ESB - Equilibrium Partitioning Sediment Benchmark.

FCV - Sediment Final Chronic Value, in organic carbon normalized units (USEPA, 2003).
J - The concentration value is estimated.
JN - The analyte was tentatively identified; the associated numerical value is an estimated quantity with an unknown bias.
NC - Not calculated.
OC - organic carbon.
$PAH_{34}$ - Polycyclic Aromatic Hydrocarbons including alkylated PAHs.
U - The target analyte was not detected above the reporting detection limit. Not included in TU calculation.
$C_{OC,PAHi,FCVi}$ - Sediment Final Chronic Value, in organic carbon normalized units for each PAH (USEPA, 2003).

(a) ΣESBTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in bold.

**Table 4-11**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Site Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Location** | SED7.5D | | SED7.5E | | SED7A | | SED7B | | SED7D | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Total Organic Carbon | mg/kg | 50000 | J | 94000 | | 79000 | J | 31000 | | 58000 | J |
| Acenaphthene | mg/kg | 0.036 | | 0.063 | | 0.026 | | 0.09 | | 0.031 | |
| Acenaphthylene | mg/kg | 0.02 | | 0.03 | | 0.022 | | 0.13 | | 0.024 | |
| Anthracene | mg/kg | 0.14 | | 0.14 | | 0.069 | | 0.17 | | 0.097 | |
| Benzo(a)anthracene | mg/kg | 0.94 | | 1.1 | | 0.71 | | 0.65 | | 0.98 | |
| Benzo(a)pyrene | mg/kg | 1 | | 1.3 | | 0.76 | | 0.79 | | 1.2 | |
| Benzo(b)fluoranthene | mg/kg | 1.5 | | 2.2 | | 1.5 | | 1 | | 1.9 | |
| Benzo(e)pyrene | mg/kg | 1 | | 1.3 | | 0.82 | | 0.64 | | 1.1 | |
| Benzo(g,h,i)perylene | mg/kg | 0.96 | | 1.1 | | 0.98 | | 0.7 | | 1.1 | |
| Benzo(k)fluoranthene | mg/kg | 0.67 | | 1.1 | | 0.64 | | 0.51 | | 0.89 | |
| C1-Benzanthracene/chrysenes | mg/kg | 2.3 | JN | 1.2 | JN | 0.75 | JN | 0.9 | JN | 0.74 | JN |
| C1-Fluorenes | mg/kg | 0.25 | JN | 0.18 | JN | 0.049 | JN | 0.26 | JN | 0.06 | JN |
| C1-Naphthalenes | mg/kg | 0.152 | | 0.31 | | 0.026 | | 0.34 | | 0.098 | |
| C1-Phenanthrene/anthracenes | mg/kg | 1.8 | JN | 0.47 | JN | 0.18 | JN | 0.77 | JN | 0.22 | JN |
| C1-Pyrene/fluoranthenes | mg/kg | 4.7 | JN | 1 | JN | 0.58 | JN | 1.1 | JN | 0.62 | JN |
| C2-Benzanthracene/chrysenes | mg/kg | 1.5 | JN | 0.86 | JN | 0.37 | JN | 0.58 | JN | 0.44 | JN |
| C2-Fluorenes | mg/kg | 1.5 | JN | 0.38 | JN | 0.096 | JN | 0.5 | JN | 0.1 | JN |
| C2-Naphthalenes | mg/kg | 0.18 | JN | 0.39 | JN | 0.054 | JN | 0.91 | JN | 0.12 | JN |
| C2-Phenanthrene/anthracenes | mg/kg | 6.5 | JN | 1 | JN | 0.27 | JN | 1.7 | JN | 0.42 | JN |
| C3-Benzanthracene/chrysenes | mg/kg | 0.74 | JN | 0.57 | JN | 0.22 | JN | 0.3 | JN | 0.26 | JN |
| C3-Fluorenes | mg/kg | 1.3 | JN | 0.49 | JN | 0.11 | JN | 0.59 | JN | 0.15 | JN |
| C3-Naphthalenes | mg/kg | 0.36 | JN | 0.47 | JN | 0.079 | JN | 2.4 | JN | 0.15 | JN |
| C3-Phenanthrene/anthracenes | mg/kg | 5.7 | JN | 0.87 | JN | 0.25 | JN | 1.2 | JN | 0.31 | JN |
| C4-Benzanthracene/chrysenes | mg/kg | 0.28 | JN | 0.32 | JN | 0.13 | JN | 0.17 | JN | 0.13 | JN |
| C4-Naphthalenes | mg/kg | 0.57 | JN | 0.46 | JN | 0.095 | JN | 2.2 | JN | 0.14 | JN |
| C4-Phenanthrenes/anthracenes | mg/kg | 2.8 | JN | 0.5 | JN | 0.13 | JN | 0.66 | JN | 0.17 | JN |
| Chrysene | mg/kg | 1.6 | | 2.1 | | 1.3 | | 0.95 | | 1.6 | |
| Dibenzo(a,h)anthracene | mg/kg | 0.18 | | 0.21 | | 0.18 | | 0.14 | | 0.2 | |
| Fluoranthene | mg/kg | 1.5 | | 2.3 | | 1.5 | | 1.1 | | 1.7 | |
| Fluorene | mg/kg | 0.071 | | 0.13 | | 0.046 | | 0.17 | | 0.054 | |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.73 | | 0.95 | | 0.73 | | 0.51 | | 0.89 | |
| Naphthalene | mg/kg | 0.07 | J | 0.12 | J | < 0.29 | U | 0.17 | | < 0.24 | U |
| Perylene | mg/kg | 0.33 | | 0.42 | | 0.29 | | 0.25 | | 0.4 | |
| Phenanthrene | mg/kg | 0.95 | | 0.96 | | 0.63 | | 1 | | 0.53 | |
| Pyrene | mg/kg | 2.7 | | 2.1 | | 1.3 | | 1.3 | | 1.5 | |
| Total $PAH_{34}$ | mg/kg | 45.0 | | 27.1 | | 14.9 | | 24.9 | | 18.3 | |
| **Toxic Unit Calculation** | $C_{OC,PAHi,FCVi}$ | | | | | | | | | | |
| Acenaphthene | 491 | 0.0015 | | 0.0014 | | 0.0007 | | 0.0059 | | 0.0011 | |
| Acenaphthylene | 452 | 0.0009 | | 0.0007 | | 0.0006 | | 0.0093 | | 0.0009 | |
| Anthracene | 594 | 0.0047 | | 0.0025 | | 0.0015 | | 0.0092 | | 0.0028 | |
| Benzo(a)anthracene | 841 | 0.0224 | | 0.0139 | | 0.0107 | | 0.0249 | | 0.0201 | |
| Benzo(a)pyrene | 965 | 0.0207 | | 0.0143 | | 0.0100 | | 0.0264 | | 0.0214 | |
| Benzo(b)fluoranthene | 979 | 0.0306 | | 0.0239 | | 0.0194 | | 0.0330 | | 0.0335 | |
| Benzo(e)pyrene | 967 | 0.0207 | | 0.0143 | | 0.0107 | | 0.0213 | | 0.0196 | |
| Benzo(g,h,i)perylene | 648 | 0.0296 | | 0.0181 | | 0.0191 | | 0.0348 | | 0.0293 | |
| Benzo(k)fluoranthene | 981 | 0.0137 | | 0.0119 | | 0.0083 | | 0.0168 | | 0.0156 | |
| C1-Benzanthracene/chrysenes | 929 | 0.0495 | | 0.0137 | | 0.0102 | | 0.0313 | | 0.0137 | |
| C1-Fluorenes | 611 | 0.0082 | | 0.0031 | | 0.0010 | | 0.0137 | | 0.0017 | |
| C1-Naphthalenes | 444 | 0.0068 | | 0.0074 | | 0.0007 | | 0.0247 | | 0.0038 | |
| C1-Phenanthrene/anthracenes | 670 | 0.0537 | | 0.0075 | | 0.0034 | | 0.0371 | | 0.0057 | |
| C1-Pyrene/fluoranthenes | 770 | 0.1221 | | 0.0138 | | 0.0095 | | 0.0461 | | 0.0139 | |
| C2-Benzanthracene/chrysenes | 1008 | 0.0298 | | 0.0091 | | 0.0046 | | 0.0186 | | 0.0075 | |
| C2-Fluorenes | 686 | 0.0437 | | 0.0059 | | 0.0018 | | 0.0235 | | 0.0025 | |
| C2-Naphthalenes | 510 | 0.0071 | | 0.0081 | | 0.0013 | | 0.0576 | | 0.0041 | |
| C2-Phenanthrene/anthracenes | 746 | 0.1743 | | 0.0143 | | 0.0046 | | 0.0735 | | 0.0097 | |
| C3-Benzanthracene/chrysenes | 1112 | 0.0133 | | 0.0055 | | 0.0025 | | 0.0087 | | 0.0040 | |
| C3-Fluorenes | 769 | 0.0338 | | 0.0068 | | 0.0018 | | 0.0247 | | 0.0034 | |
| C3-Naphthalenes | 581 | 0.0124 | | 0.0086 | | 0.0017 | | 0.1333 | | 0.0045 | |
| C3-Phenanthrene/anthracenes | 829 | 0.1375 | | 0.0112 | | 0.0038 | | 0.0467 | | 0.0064 | |
| C4-Benzanthracene/chrysenes | 1214 | 0.0046 | | 0.0028 | | 0.0014 | | 0.0045 | | 0.0018 | |
| C4-Naphthalenes | 657 | 0.0174 | | 0.0074 | | 0.0018 | | 0.1080 | | 0.0037 | |
| C4-Phenanthrenes/anthracenes | 913 | 0.0613 | | 0.0058 | | 0.0018 | | 0.0233 | | 0.0032 | |

**Table 4-11**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Site Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Location** | SED7.5D | | SED7.5E | | SED7A | | SED7B | | SED7D | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Chrysene | 826 | 0.0387 | | 0.0270 | | 0.0199 | | 0.0371 | | 0.0334 | |
| Dibenzo(a,h)anthracene | 1123 | 0.0032 | | 0.0020 | | 0.0020 | | 0.0040 | | 0.0031 | |
| Fluoranthene | 707 | 0.0424 | | 0.0346 | | 0.0269 | | 0.0502 | | 0.0415 | |
| Fluorene | 538 | 0.0026 | | 0.0026 | | 0.0011 | | 0.0102 | | 0.0017 | |
| Indeno(1,2,3-cd)pyrene | 1115 | 0.0131 | | 0.0091 | | 0.0083 | | 0.0148 | | 0.0138 | |
| Naphthalene | 385 | 0.0036 | | 0.0033 | | NC | | 0.0142 | | NC | |
| Perylene | 967 | 0.0068 | | 0.0046 | | 0.0038 | | 0.0083 | | 0.0071 | |
| Phenanthrene | 596 | 0.0319 | | 0.0171 | | 0.0134 | | 0.0541 | | 0.0153 | |
| Pyrene | 697 | 0.0775 | | 0.0321 | | 0.0236 | | 0.0602 | | 0.0371 | |
| **ΣESBTU (a)** | | **1.14** | | 0.36 | | 0.23 | | **1.11** | | 0.39 | |

Notes:
< - Result not detected above laboratory reporting limit.
mg/kg - milligrams per kilogram.
ΣESBTU - Sum of the toxic units within a sample. Calculated as OC normalized sediment concentration divided by OC normalized equilibrium partitioning (EqP) sediment criterion corresponding to pore water FCV for each PAH.
ESB - Equilibrium Partitioning Sediment Benchmark.

FCV - Sediment Final Chronic Value, in organic carbon normalized units (USEPA, 2003).
J - The concentration value is estimated.
JN - The analyte was tentatively identified; the associated numerical value is an estimated quantity with an unknown bias.
NC - Not calculated.
OC - organic carbon.
$PAH_{34}$ - Polycyclic Aromatic Hydrocarbons including alkylated PAHs.
U - The target analyte was not detected above the reporting detection limit. Not included in TU calculation.
$C_{OC,PAHi,FCVi}$ - Sediment Final Chronic Value, in organic carbon normalized units for each PAH (USEPA, 2003).

(a) ΣESBTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in bold.

**Table 4-11**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Site Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Location | SED7E | | SED7F | | SED8A | | SED8B | | SED8C | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Total Organic Carbon | mg/kg | 45000 | | 58000 | | 66000 | J | 67000 | J | 44000 | |
| Acenaphthene | mg/kg | 0.046 | | 0.044 | | 0.026 | | 0.022 | | 0.027 | |
| Acenaphthylene | mg/kg | 0.02 | | 0.024 | | 0.026 | | 0.015 | | 0.025 | |
| Anthracene | mg/kg | 0.1 | | 0.12 | | 0.071 | | 0.064 | | 0.09 | |
| Benzo(a)anthracene | mg/kg | 1.1 | | 0.86 | | 0.77 | | 0.71 | | 0.83 | |
| Benzo(a)pyrene | mg/kg | 0.88 | | 1.1 | | 0.9 | | 0.75 | | 0.96 | |
| Benzo(b)fluoranthene | mg/kg | 1.6 | | 1.9 | | 1.7 | | 1.2 | | 1.8 | |
| Benzo(e)pyrene | mg/kg | 0.84 | | 1 | | 0.95 | | 0.68 | | 0.95 | |
| Benzo(g,h,i)perylene | mg/kg | 0.91 | | 1.1 | | 0.97 | | 0.72 | | 1 | |
| Benzo(k)fluoranthene | mg/kg | 0.78 | | 0.76 | | 0.65 | | 0.59 | | 0.84 | |
| C1-Benzanthracene/chrysenes | mg/kg | 0.85 | JN | 1.1 | JN | 0.7 | JN | 0.51 | JN | 0.87 | JN |
| C1-Fluorenes | mg/kg | 0.13 | JN | 0.11 | JN | 0.048 | JN | 0.029 | JN | 0.06 | JN |
| C1-Naphthalenes | mg/kg | 0.197 | | 0.225 | | 0.022 | | 0.13 | | 0.074 | |
| C1-Phenanthrene/anthracenes | mg/kg | 0.33 | JN | 0.45 | JN | 0.17 | JN | 0.15 | JN | 0.2 | JN |
| C1-Pyrene/fluoranthenes | mg/kg | 0.59 | JN | 1.1 | JN | 0.59 | JN | 0.5 | JN | 0.59 | JN |
| C2-Benzanthracene/chrysenes | mg/kg | 0.58 | JN | 0.9 | JN | 0.35 | JN | 0.27 | JN | 0.44 | JN |
| C2-Fluorenes | mg/kg | 0.27 | JN | 0.43 | JN | 0.086 | JN | 0.057 | JN | 0.12 | JN |
| C2-Naphthalenes | mg/kg | 0.27 | JN | 0.24 | JN | 0.058 | JN | 0.035 | JN | 0.082 | JN |
| C2-Phenanthrene/anthracenes | mg/kg | 0.73 | JN | 1.3 | JN | 0.28 | JN | 0.18 | JN | 0.35 | JN |
| C3-Benzanthracene/chrysenes | mg/kg | 0.33 | JN | 0.59 | JN | 0.22 | JN | 0.15 | JN | 0.27 | JN |
| C3-Fluorenes | mg/kg | 0.31 | JN | 0.49 | JN | 0.13 | JN | 0.071 | JN | 0.16 | JN |
| C3-Naphthalenes | mg/kg | 0.38 | JN | 0.28 | JN | 0.074 | JN | 0.048 | JN | 0.14 | JN |
| C3-Phenanthrene/anthracenes | mg/kg | 0.52 | JN | 1.2 | JN | 0.22 | JN | 0.14 | JN | 0.27 | JN |
| C4-Benzanthracene/chrysenes | mg/kg | 0.22 | JN | 0.3 | JN | 0.12 | JN | 0.079 | JN | 0.17 | JN |
| C4-Naphthalenes | mg/kg | 0.35 | JN | 0.24 | JN | 0.089 | JN | 0.053 | JN | 0.14 | JN |
| C4-Phenanthrenes/anthracenes | mg/kg | 0.27 | JN | 0.58 | JN | 0.11 | JN | 0.07 | JN | 0.16 | JN |
| Chrysene | mg/kg | 1.5 | | 1.5 | | 1.4 | | 1 | | 1.4 | |
| Dibenzo(a,h)anthracene | mg/kg | 0.15 | | 0.17 | | 0.19 | | 0.15 | | 0.18 | |
| Fluoranthene | mg/kg | 1.7 | | 1.6 | | 1.6 | | 1.4 | | 1.6 | |
| Fluorene | mg/kg | 0.088 | | 0.075 | | 0.043 | | 0.034 | | 0.049 | |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.72 | | 0.79 | | 0.79 | | 0.57 | | 0.76 | |
| Naphthalene | mg/kg | 0.087 | J | 0.094 | J | < 0.27 | U | < 0.26 | U | < 0.26 | U |
| Perylene | mg/kg | 0.24 | | 0.32 | | 0.32 | | 0.26 | | 0.39 | |
| Phenanthrene | mg/kg | 0.82 | | 0.75 | | 0.54 | | 0.6 | | 0.58 | |
| Pyrene | mg/kg | 1.4 | | 1.5 | | 1.3 | | 1.2 | | 1.4 | |
| Total PAH$_{34}$ | mg/kg | 19.3 | | 23.2 | | 15.5 | | 12.4 | | 17.0 | |
| **Toxic Unit Calculation** | $C_{OC,PAHi,FCVi}$ | | | | | | | | | | |
| Acenaphthene | 491 | 0.0021 | | 0.0015 | | 0.0008 | | 0.0007 | | 0.0012 | |
| Acenaphthylene | 452 | 0.0010 | | 0.0009 | | 0.0009 | | 0.0005 | | 0.0013 | |
| Anthracene | 594 | 0.0037 | | 0.0035 | | 0.0018 | | 0.0016 | | 0.0034 | |
| Benzo(a)anthracene | 841 | 0.0291 | | 0.0176 | | 0.0139 | | 0.0126 | | 0.0224 | |
| Benzo(a)pyrene | 965 | 0.0203 | | 0.0197 | | 0.0141 | | 0.0116 | | 0.0226 | |
| Benzo(b)fluoranthene | 979 | 0.0363 | | 0.0335 | | 0.0263 | | 0.0183 | | 0.0418 | |
| Benzo(e)pyrene | 967 | 0.0193 | | 0.0178 | | 0.0149 | | 0.0105 | | 0.0223 | |
| Benzo(g,h,i)perylene | 648 | 0.0312 | | 0.0293 | | 0.0227 | | 0.0166 | | 0.0351 | |
| Benzo(k)fluoranthene | 981 | 0.0177 | | 0.0134 | | 0.0100 | | 0.0090 | | 0.0195 | |
| C1-Benzanthracene/chrysenes | 929 | 0.0203 | | 0.0204 | | 0.0114 | | 0.0082 | | 0.0213 | |
| C1-Fluorenes | 611 | 0.0047 | | 0.0031 | | 0.0012 | | 0.0007 | | 0.0022 | |
| C1-Naphthalenes | 444 | 0.0099 | | 0.0087 | | 0.0008 | | 0.0044 | | 0.0038 | |
| C1-Phenanthrene/anthracenes | 670 | 0.0109 | | 0.0116 | | 0.0038 | | 0.0033 | | 0.0068 | |
| C1-Pyrene/fluoranthenes | 770 | 0.0170 | | 0.0246 | | 0.0116 | | 0.0097 | | 0.0174 | |
| C2-Benzanthracene/chrysenes | 1008 | 0.0128 | | 0.0154 | | 0.0053 | | 0.0040 | | 0.0099 | |
| C2-Fluorenes | 686 | 0.0087 | | 0.0108 | | 0.0019 | | 0.0012 | | 0.0040 | |
| C2-Naphthalenes | 510 | 0.0118 | | 0.0081 | | 0.0017 | | 0.0010 | | 0.0037 | |
| C2-Phenanthrene/anthracenes | 746 | 0.0217 | | 0.0300 | | 0.0057 | | 0.0036 | | 0.0107 | |
| C3-Benzanthracene/chrysenes | 1112 | 0.0066 | | 0.0091 | | 0.0030 | | 0.0020 | | 0.0055 | |
| C3-Fluorenes | 769 | 0.0090 | | 0.0110 | | 0.0026 | | 0.0014 | | 0.0047 | |
| C3-Naphthalenes | 581 | 0.0145 | | 0.0083 | | 0.0019 | | 0.0012 | | 0.0055 | |
| C3-Phenanthrene/anthracenes | 829 | 0.0139 | | 0.0250 | | 0.0040 | | 0.0025 | | 0.0074 | |
| C4-Benzanthracene/chrysenes | 1214 | 0.0040 | | 0.0043 | | 0.0015 | | 0.0010 | | 0.0032 | |
| C4-Naphthalenes | 657 | 0.0118 | | 0.0063 | | 0.0021 | | 0.0012 | | 0.0048 | |
| C4-Phenanthrenes/anthracenes | 913 | 0.0066 | | 0.0110 | | 0.0018 | | 0.0011 | | 0.0040 | |

**Table 4-11**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Sediment Benchmarks**

| | | Site Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Location | SED7E | | SED7F | | SED8A | | SED8B | | SED8C | |
| **Detected Analyte** | **Units** | | | | | | | | | | |
| Chrysene | 826 | 0.0404 | | 0.0313 | | 0.0257 | | 0.0181 | | 0.0385 | |
| Dibenzo(a,h)anthracene | 1123 | 0.0030 | | 0.0026 | | 0.0026 | | 0.0020 | | 0.0036 | |
| Fluoranthene | 707 | 0.0534 | | 0.0390 | | 0.0343 | | 0.0296 | | 0.0514 | |
| Fluorene | 538 | 0.0036 | | 0.0024 | | 0.0012 | | 0.0009 | | 0.0021 | |
| Indeno(1,2,3-cd)pyrene | 1115 | 0.0143 | | 0.0122 | | 0.0107 | | 0.0076 | | 0.0155 | |
| Naphthalene | 385 | 0.0050 | | 0.0042 | | NC | | NC | | NC | |
| Perylene | 967 | 0.0055 | | 0.0057 | | 0.0050 | | 0.0040 | | 0.0092 | |
| Phenanthrene | 596 | 0.0306 | | 0.0217 | | 0.0137 | | 0.0150 | | 0.0221 | |
| Pyrene | 697 | 0.0446 | | 0.0371 | | 0.0283 | | 0.0257 | | 0.0457 | |
| **ΣESBTU (a)** | | 0.55 | | 0.50 | | 0.29 | | 0.23 | | 0.47 | |

Notes:
< - Result not detected above laboratory reporting limit.
mg/kg - milligrams per kilogram.
ΣESBTU - Sum of the toxic units within a sample. Calculated as OC normalized sediment concentration divided by OC normalized equilibrium partitioning (EqP) sediment criterion corresponding to pore water FCV for each PAH.
ESB - Equilibrium Partitioning Sediment Benchmark.

FCV - Sediment Final Chronic Value, in organic carbon normalized units (USEPA, 2003).
J - The concentration value is estimated.
JN - The analyte was tentatively identified; the associated numerical value is an estimated quantity with an unknown bias.
NC - Not calculated.
OC - organic carbon.
$PAH_{34}$ - Polycyclic Aromatic Hydrocarbons including alkylated PAHs.
U - The target analyte was not detected above the reporting detection limit. Not included in TU calculation.
$C_{OC,PAHi,FCVi}$ - Sediment Final Chronic Value, in organic carbon normalized units for each PAH (USEPA, 2003).

(a) ΣESBTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in bold.

**Table 4-12**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Pore Water Benchmarks**

| | | **Reference Samples** | | | | | | | | | | **Site Samples** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SEDBACK16 | | SEDBACK17 | | SEDBACK18 | | SEDBACK19 | | SEDBACK20 | | SED6.5D | | SED6.5E | | SED6A | |
| **Detected Analyte** | **Units** | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | ug/l | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U |
| 2-Methylnaphthalene | ug/l | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U |
| Acenaphthene | ug/l | <1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U |
| Acenaphthylene | ug/l | <9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U |
| Anthracene | ug/l | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U |
| Benzo(a)anthracene | ug/l | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U |
| Benzo(a)pyrene | ug/l | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U |
| Benzo(b,k)fluoranthene | ug/l | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U |
| Benzo(e)pyrene | ug/l | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U |
| Benzo(g,h,i)perylene | ug/l | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U |
| C1-Chrysenes | ug/l | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U |
| C1-Fluorenes | ug/l | < 0.41 | U | < 0.41 | U | < 0.41 | U | < 0.41 | U | < 0.41 | U | < 0.41 | U | 0.26 | JN | < 0.41 | U |
| C1-Phenanthrene/anthracenes | ug/l | 0.02 | JN | < 0.22 | U | < 0.22 | U | < 0.22 | U | < 0.22 | U | < 0.22 | U | 0.03 | JN | < 0.22 | U |
| C1-Pyrene/fluoranthenes | ug/l | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U |
| C2-Chrysenes | ug/l | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U |
| C2-Fluorenes | ug/l | < 0.16 | U | < 0.16 | U | < 0.16 | U | < 0.16 | U | < 0.16 | U | < 0.16 | U | 0.29 | JN | < 0.16 | U |
| C2-Naphthalenes | ug/l | < 0.89 | U | < 0.89 | U | < 0.89 | U | < 0.89 | U | < 0.89 | U | < 0.89 | U | 0.2 | JN | < 0.89 | U |
| C2-Phenanthrene/anthracenes | ug/l | < 0.09 | U | < 0.09 | U | < 0.09 | U | < 0.09 | U | < 0.09 | U | < 0.09 | U | 0.1 | JN | < 0.09 | U |
| C3-Chrysenes | ug/l | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| C3-Fluorenes | ug/l | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U |
| C3-Naphthalenes | ug/l | 0.06 | JN | 0.07 | JN | 0.06 | JN | 0.09 | JN | < 0.33 | U | 0.12 | JN | 0.34 | JN | 0.06 | JN |
| C3-Phenanthrene/anthracenes | ug/l | < 0.04 | U | < 0.04 | U | < 0.04 | U | < 0.04 | U | < 0.04 | U | < 0.04 | U | 0.17 | JN | < 0.04 | U |
| C4-Chrysenes | ug/l | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U |
| C4-Naphthalenes | ug/l | < 0.12 | U | < 0.12 | U | < 0.12 | U | < 0.12 | U | < 0.12 | U | 0.34 | JN | 0.92 | JN | < 0.12 | U |
| C4-Phenanthrenes/anthracenes | ug/l | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U |
| Chrysene | ug/l | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U |
| Dibenzo(a,h)anthracene | ug/l | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U |
| Fluoranthene | ug/l | 0.02 | J | 0.01 | J | 0.01 | J | 0.01 | J | 0.02 | J | 0.01 | J | 0.02 | J | 0.02 | J |
| Fluorene | ug/l | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U |
| Indeno(1,2,3-cd)pyrene | ug/l | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U |
| Naphthalene | ug/l | 0.17 | J | 0.13 | J | < 5.7 | U | < 5.7 | U | 0.11 | J | 0.22 | J | 0.1 | J | 0.11 | J |
| Perylene | ug/l | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U |
| Phenanthrene | ug/l | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U |
| Pyrene | ug/l | 0.01 | J | 0.01 | J | 0.02 | J | 0.02 | J | 0.03 | J | 0.02 | J | 0.03 | J | 0.02 | J |

**Table 4-12**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Pore Water Benchmarks**

| | | **Reference Samples** | | | | | | | | | | **Site Samples** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SEDBACK16 | | SEDBACK17 | | SEDBACK18 | | SEDBACK19 | | SEDBACK20 | | SED6.5D | | SED6.5E | | SED6A | |
| **Detected Analyte** | **Units** | | | | | | | | | | | | | | | | |
| **Toxic Unit Calculation** | **FCV (ug/L)** | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 75.37 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| 2-Methylnaphthalene | 72.16 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Acenaphthene | 55.85 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Acenaphthylene | 306.9 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Anthracene | 20.73 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Benzo(a)anthracene | 2.227 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Benzo(a)pyrene | 0.96 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Benzo(b,k)fluoranthene | 0.65 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Benzo(e)pyrene | 0.9 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Benzo(g,h,i)perylene | 0.44 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| C1-Chrysenes | 0.86 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| C1-Fluorenes | 13.99 | NC | | NC | | NC | | NC | | NC | | NC | | 0.019 | | NC | |
| C1-Phenanthrene/anthracenes | 7.44 | 0.0027 | | NC | | NC | | NC | | NC | | NC | | 0.004 | | NC | |
| C1-Pyrene/fluoranthenes | 4.89 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| C2-Chrysenes | 0.48 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| C2-Fluorenes | 5.305 | NC | | NC | | NC | | NC | | NC | | NC | | 0.055 | | NC | |
| C2-Naphthalenes | 30.24 | NC | | NC | | NC | | NC | | NC | | NC | | 0.0066 | | NC | |
| C2-Phenanthrene/anthracenes | 3.2 | NC | | NC | | NC | | NC | | NC | | NC | | 0.031 | | NC | |
| C3-Chrysenes | 0.17 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| C3-Fluorenes | 1.916 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| C3-Naphthalenes | 11.1 | 0.0054 | | 0.0063 | | 0.0054 | | 0.0081 | | NC | | 0.011 | | 0.031 | | 0.0054 | |
| C3-Phenanthrene/anthracenes | 1.26 | NC | | NC | | NC | | NC | | NC | | NC | | 0.13 | | NC | |
| C4-Chrysenes | 0.07 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| C4-Naphthalenes | 4.048 | NC | | NC | | NC | | NC | | NC | | 0.084 | | 0.23 | | NC | |
| C4-Phenanthrenes/anthracenes | 0.5594 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Chrysene | 2.042 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Dibenzo(a,h)anthracene | 0.28 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Fluoranthene | 7.109 | 0.0028 | | 0.0014 | | 0.0014 | | 0.0014 | | 0.0028 | | 0.0014 | | 0.0028 | | 0.0028 | |
| Fluorene | 39.3 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Indeno(1,2,3-cd)pyrene | 0.27 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Naphthalene | 193.5 | 0.00088 | | 0.00067 | | NC | | NC | | 0.00057 | | 0.00114 | | 0.00052 | | 0.00057 | |
| Perylene | 0.9 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Phenanthrene | 19.13 | NC | | NC | | NC | | NC | | NC | | NC | | NC | | NC | |
| Pyrene | 10.11 | 0.00099 | | 0.00099 | | 0.0020 | | 0.0020 | | 0.0030 | | 0.0020 | | 0.0030 | | 0.0020 | |
| **ΣEqPTUFCV, 34 (a)** | | 0.013 | | 0.009 | | 0.009 | | 0.011 | | 0.006 | | 0.099 | | 0.514 | | 0.011 | |

Notes:
< - Result not detected above laboratory reporting limit.
ug/kg - micrograms per kilogram.
Cpw - the concentration of freely dissolved PAH in porewater
FCV - Final Chronic Value, in organic carbon normalized units (USEPA, 2003).
J - The concentration value is estimated.
JN - The analyte was tentatively identified; the associated numerical value is an estimated quantity with an unknown bias.
NC - Not calculated.
$PAH_{34}$ - Polycyclic Aromatic Hydrocarbons including alkylated PAHs.
U - The target analyte was not detected above the reporting detection limit. Not included in TU calculation.
(a) ΣEqPTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in bold.

**Table 4-12**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Pore Water Benchmarks**

| | | Site Samples | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SED6B | | SED6C | | SED7.5D | | SED7.5E | | SED7A | | SED7B | | SED7D | | SED7E | |
| **Detected Analyte** | **Units** | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | ug/l | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U |
| 2-Methylnaphthalene | ug/l | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U |
| Acenaphthene | ug/l | < 1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U | 0.15 | J | < 1.6 | U | < 1.6 | U |
| Acenaphthylene | ug/l | < 9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U | < 9 | U |
| Anthracene | ug/l | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U |
| Benzo(a)anthracene | ug/l | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U |
| Benzo(a)pyrene | ug/l | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U |
| Benzo(b,k)fluoranthene | ug/l | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U |
| Benzo(e)pyrene | ug/l | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U |
| Benzo(g,h,i)perylene | ug/l | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U |
| C1-Chrysenes | ug/l | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U |
| C1-Fluorenes | ug/l | < 0.41 | U | < 0.41 | U | < 0.41 | U | < 0.41 | U | < 0.41 | U | 0.88 | JN | < 0.41 | U | 0.17 | JN |
| C1-Phenanthrene/anthracenes | ug/l | < 0.22 | U | < 0.22 | U | < 0.22 | U | < 0.22 | U | < 0.22 | U | 0.19 | JN | < 0.22 | U | < 0.22 | U |
| C1-Pyrene/fluoranthenes | ug/l | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U |
| C2-Chrysenes | ug/l | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U |
| C2-Fluorenes | ug/l | < 0.16 | U | < 0.16 | U | < 0.16 | U | < 0.16 | U | < 0.16 | U | 0.68 | JN | < 0.16 | U | < 0.16 | U |
| C2-Naphthalenes | ug/l | < 0.89 | U | < 0.89 | U | 0.17 | JN | < 0.89 | U | 0.15 | JN | 1.48 | JN | < 0.89 | U | 0.17 | JN |
| C2-Phenanthrene/anthracenes | ug/l | < 0.09 | U | < 0.09 | U | < 0.09 | U | < 0.09 | U | < 0.09 | U | 0.23 | JN | < 0.09 | U | 0.06 | JN |
| C3-Chrysenes | ug/l | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| C3-Fluorenes | ug/l | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U |
| C3-Naphthalenes | ug/l | 0.08 | JN | 0.18 | JN | 0.1 | JN | 0.18 | JN | 0.07 | JN | 4.06 | JN | 0.08 | JN | 0.19 | JN |
| C3-Phenanthrene/anthracenes | ug/l | < 0.04 | U | < 0.04 | U | < 0.04 | U | < 0.04 | U | < 0.04 | U | 0.2 | JN | < 0.04 | U | < 0.04 | U |
| C4-Chrysenes | ug/l | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U |
| C4-Naphthalenes | ug/l | < 0.12 | U | 0.46 | JN | < 0.12 | U | 0.34 | JN | 0.16 | JN | 3.62 | JN | < 0.12 | U | 0.41 | JN |
| C4-Phenanthrenes/anthracenes | ug/l | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U |
| Chrysene | ug/l | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U |
| Dibenzo(a,h)anthracene | ug/l | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U |
| Fluoranthene | ug/l | 0.02 | J | 0.03 | J | 0.02 | J | 0.03 | J | 0.02 | J | 0.09 | J | 0.02 | J | 0.02 | J |
| Fluorene | ug/l | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U | 0.13 | J | < 1.2 | U | < 1.2 | U |
| Indeno(1,2,3-cd)pyrene | ug/l | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U |
| Naphthalene | ug/l | 0.13 | J | 0.11 | J | 0.12 | J | < 5.7 | U | 0.13 | J | 0.15 | J | < 5.7 | U | 0.1 | J |
| Perylene | ug/l | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U |
| Phenanthrene | ug/l | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U | 0.31 | J | < 0.56 | U | < 0.56 | U |
| Pyrene | ug/l | 0.02 | J | 0.04 | J | 0.03 | J | 0.03 | J | 0.02 | J | 0.12 | J | 0.03 | J | 0.02 | J |

**Table 4-12**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Pore Water Benchmarks**

| | | Site Samples | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SED6B | SED6C | SED7.5D | SED7.5E | SED7A | SED7B | SED7D | SED7E |
| **Detected Analyte** | **Units** | | | | | | | | |
| **Toxic Unit Calculation** | **FCV (ug/L)** | | | | | | | | |
| 1-Methylnaphthalene | 75.37 | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Methylnaphthalene | 72.16 | NC | NC | NC | NC | NC | NC | NC | NC |
| Acenaphthene | 55.85 | NC | NC | NC | NC | NC | 0.003 | NC | NC |
| Acenaphthylene | 306.9 | NC | NC | NC | NC | NC | NC | NC | NC |
| Anthracene | 20.73 | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | 2.227 | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | 0.96 | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b,k)fluoranthene | 0.65 | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(e)pyrene | 0.9 | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(g,h,i)perylene | 0.44 | NC | NC | NC | NC | NC | NC | NC | NC |
| C1-Chrysenes | 0.86 | NC | NC | NC | NC | NC | NC | NC | NC |
| C1-Fluorenes | 13.99 | NC | NC | NC | NC | NC | 0.063 | NC | 0.012 |
| C1-Phenanthrene/anthracenes | 7.44 | NC | NC | NC | NC | NC | 0.026 | NC | NC |
| C1-Pyrene/fluoranthenes | 4.89 | NC | NC | NC | NC | NC | NC | NC | NC |
| C2-Chrysenes | 0.48 | NC | NC | NC | NC | NC | NC | NC | NC |
| C2-Fluorenes | 5.305 | NC | NC | NC | NC | NC | 0.13 | NC | NC |
| C2-Naphthalenes | 30.24 | NC | NC | 0.0056 | NC | 0.0050 | 0.049 | NC | 0.0056 |
| C2-Phenanthrene/anthracenes | 3.2 | NC | NC | NC | NC | NC | 0.072 | NC | 0.019 |
| C3-Chrysenes | 0.17 | NC | NC | NC | NC | NC | NC | NC | NC |
| C3-Fluorenes | 1.916 | NC | NC | NC | NC | NC | NC | NC | NC |
| C3-Naphthalenes | 11.1 | 0.0072 | 0.016 | 0.0090 | 0.0162 | 0.0063 | 0.37 | 0.0072 | 0.017 |
| C3-Phenanthrene/anthracenes | 1.26 | NC | NC | NC | NC | NC | 0.16 | NC | NC |
| C4-Chrysenes | 0.07 | NC | NC | NC | NC | NC | NC | NC | NC |
| C4-Naphthalenes | 4.048 | NC | 0.114 | NC | 0.083992095 | 0.039525692 | 0.894 | NC | 0.10 |
| C4-Phenanthrenes/anthracenes | 0.5594 | NC | NC | NC | NC | NC | NC | NC | NC |
| Chrysene | 2.042 | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | 0.28 | NC | NC | NC | NC | NC | NC | NC | NC |
| Fluoranthene | 7.109 | 0.0028 | 0.0042 | 0.0028 | 0.0042 | 0.0028 | 0.013 | 0.0028 | 0.0028 |
| Fluorene | 39.3 | NC | NC | NC | NC | NC | 0.003 | NC | NC |
| Indeno(1,2,3-cd)pyrene | 0.27 | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | 193.5 | 0.00067 | 0.00057 | 0.00062 | NC | 0.00067 | 0.001 | NC | 0.00052 |
| Perylene | 0.9 | NC | NC | NC | NC | NC | NC | NC | NC |
| Phenanthrene | 19.13 | NC | NC | NC | NC | NC | 0.016 | NC | NC |
| Pyrene | 10.11 | 0.0020 | 0.0040 | 0.0030 | 0.0030 | 0.0020 | 0.0119 | 0.0030 | 0.0020 |
| **ΣEqPTUFCV, 34 (a)** | | 0.013 | 0.139 | 0.021 | 0.107 | 0.056 | **1.804** | 0.013 | 0.160 |

Notes:
< - Result not detected above laboratory reporting limit.
ug/kg - micrograms per kilogram.
Cpw - the concentration of freely dissolved PAH in porewater
FCV - Final Chronic Value, in organic carbon normalized units (USEPA, 2003).
J - The concentration value is estimated.
JN - The analyte was tentatively identified; the associated numerical value is an estimated quantity with an unknown bias.
NC - Not calculated.
$PAH_{34}$ - Polycyclic Aromatic Hydrocarbons including alkylated PAHs.
U - The target analyte was not detected above the reporting detection limit. Not included in TU calculation.
(a) ΣEqPTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in bold.

**Table 4-12**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Pore Water Benchmarks**

| | | Site Samples | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SED7F | | SED8A | | SED8B | | SED8C | |
| **Detected Analyte** | **Units** | | | | | | | | |
| 1-Methylnaphthalene | ug/l | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U |
| 2-Methylnaphthalene | ug/l | < 2.4 | U | < 2.4 | U | < 2.4 | U | < 2.4 | U |
| Acenaphthene | ug/l | < 1.6 | U | < 1.6 | U | < 1.6 | U | < 1.6 | U |
| Acenaphthylene | ug/l | < 9 | U | < 9 | U | < 9 | U | < 9 | U |
| Anthracene | ug/l | < 0.61 | U | < 0.61 | U | < 0.61 | U | < 0.61 | U |
| Benzo(a)anthracene | ug/l | < 0.066 | U | < 0.066 | U | < 0.066 | U | < 0.066 | U |
| Benzo(a)pyrene | ug/l | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U |
| Benzo(b,k)fluoranthene | ug/l | < 0.019 | U | < 0.019 | U | < 0.019 | U | < 0.019 | U |
| Benzo(e)pyrene | ug/l | < 0.028 | U | < 0.028 | U | < 0.028 | U | < 0.028 | U |
| Benzo(g,h,i)perylene | ug/l | < 0.013 | U | < 0.013 | U | < 0.013 | U | < 0.013 | U |
| C1-Chrysenes | ug/l | < 0.025 | U | < 0.025 | U | < 0.025 | U | < 0.025 | U |
| C1-Fluorenes | ug/l | < 0.41 | U | < 0.41 | U | < 0.41 | U | < 0.41 | U |
| C1-Phenanthrene/anthracenes | ug/l | < 0.22 | U | < 0.22 | U | < 0.22 | U | < 0.22 | U |
| C1-Pyrene/fluoranthenes | ug/l | < 0.14 | U | < 0.14 | U | < 0.14 | U | < 0.14 | U |
| C2-Chrysenes | ug/l | < 0.014 | U | < 0.014 | U | < 0.014 | U | < 0.014 | U |
| C2-Fluorenes | ug/l | < 0.16 | U | < 0.16 | U | < 0.16 | U | < 0.16 | U |
| C2-Naphthalenes | ug/l | < 0.89 | U | < 0.89 | U | 0.18 | JN | < 0.89 | U |
| C2-Phenanthrene/anthracenes | ug/l | < 0.09 | U | < 0.09 | U | < 0.09 | U | < 0.09 | U |
| C3-Chrysenes | ug/l | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| C3-Fluorenes | ug/l | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U |
| C3-Naphthalenes | ug/l | 0.09 | JN | 0.11 | JN | 0.11 | JN | 0.1 | JN |
| C3-Phenanthrene/anthracenes | ug/l | < 0.04 | U | < 0.04 | U | 0.08 | JN | < 0.04 | U |
| C4-Chrysenes | ug/l | < 0.002 | U | < 0.002 | U | < 0.002 | U | < 0.002 | U |
| C4-Naphthalenes | ug/l | 0.43 | JN | < 0.12 | U | 0.3 | JN | 0.35 | JN |
| C4-Phenanthrenes/anthracenes | ug/l | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U |
| Chrysene | ug/l | < 0.06 | U | < 0.06 | U | < 0.06 | U | < 0.06 | U |
| Dibenzo(a,h)anthracene | ug/l | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U |
| Fluoranthene | ug/l | 0.02 | J | 0.02 | J | 0.02 | J | 0.03 | J |
| Fluorene | ug/l | < 1.2 | U | < 1.2 | U | < 1.2 | U | < 1.2 | U |
| Indeno(1,2,3-cd)pyrene | ug/l | < 0.008 | U | < 0.008 | U | < 0.008 | U | < 0.008 | U |
| Naphthalene | ug/l | 0.11 | J | 0.13 | J | 0.12 | J | 0.12 | J |
| Perylene | ug/l | < 0.026 | U | < 0.026 | U | < 0.026 | U | < 0.026 | U |
| Phenanthrene | ug/l | < 0.56 | U | < 0.56 | U | < 0.56 | U | < 0.56 | U |
| Pyrene | ug/l | 0.02 | J | 0.02 | J | 0.02 | J | 0.03 | J |

**Table 4-12**
**Evaluation of Parent and Alkylated PAHs Using the Equilibrium Partitioning Pore Water Benchmarks**

| | | Site Samples | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SED7F | | SED8A | | SED8B | | SED8C | |
| **Detected Analyte** | **Units** | | | | | | | | |
| **Toxic Unit Calculation** | **FCV (ug/L)** | | | | | | | | |
| 1-Methylnaphthalene | 75.37 | NC | | NC | | NC | | NC | |
| 2-Methylnaphthalene | 72.16 | NC | | NC | | NC | | NC | |
| Acenaphthene | 55.85 | NC | | NC | | NC | | NC | |
| Acenaphthylene | 306.9 | NC | | NC | | NC | | NC | |
| Anthracene | 20.73 | NC | | NC | | NC | | NC | |
| Benzo(a)anthracene | 2.227 | NC | | NC | | NC | | NC | |
| Benzo(a)pyrene | 0.96 | NC | | NC | | NC | | NC | |
| Benzo(b,k)fluoranthene | 0.65 | NC | | NC | | NC | | NC | |
| Benzo(e)pyrene | 0.9 | NC | | NC | | NC | | NC | |
| Benzo(g,h,i)perylene | 0.44 | NC | | NC | | NC | | NC | |
| C1-Chrysenes | 0.86 | NC | | NC | | NC | | NC | |
| C1-Fluorenes | 13.99 | NC | | NC | | NC | | NC | |
| C1-Phenanthrene/anthracenes | 7.44 | NC | | NC | | NC | | NC | |
| C1-Pyrene/fluoranthenes | 4.89 | NC | | NC | | NC | | NC | |
| C2-Chrysenes | 0.48 | NC | | NC | | NC | | NC | |
| C2-Fluorenes | 5.305 | NC | | NC | | NC | | NC | |
| C2-Naphthalenes | 30.24 | NC | | NC | | 0.0060 | | NC | |
| C2-Phenanthrene/anthracenes | 3.2 | NC | | NC | | NC | | NC | |
| C3-Chrysenes | 0.17 | NC | | NC | | NC | | NC | |
| C3-Fluorenes | 1.916 | NC | | NC | | NC | | NC | |
| C3-Naphthalenes | 11.1 | 0.0081 | | 0.0099 | | 0.0099 | | 0.0090 | |
| C3-Phenanthrene/anthracenes | 1.26 | NC | | NC | | 0.063 | | NC | |
| C4-Chrysenes | 0.07 | NC | | NC | | NC | | NC | |
| C4-Naphthalenes | 4.048 | 0.106225296 | | NC | | 0.074 | | 0.086 | |
| C4-Phenanthrenes/anthracenes | 0.5594 | NC | | NC | | NC | | NC | |
| Chrysene | 2.042 | NC | | NC | | NC | | NC | |
| Dibenzo(a,h)anthracene | 0.28 | NC | | NC | | NC | | NC | |
| Fluoranthene | 7.109 | 0.0028 | | 0.0028 | | 0.0028 | | 0.0042 | |
| Fluorene | 39.3 | NC | | NC | | NC | | NC | |
| Indeno(1,2,3-cd)pyrene | 0.27 | NC | | NC | | NC | | NC | |
| Naphthalene | 193.5 | 0.00057 | | 0.00067 | | 0.00062 | | 0.00062 | |
| Perylene | 0.9 | NC | | NC | | NC | | NC | |
| Phenanthrene | 19.13 | NC | | NC | | NC | | NC | |
| Pyrene | 10.11 | 0.0020 | | 0.0020 | | 0.0020 | | 0.0030 | |
| **ΣEqPTUFCV, 34 (a)** | | 0.120 | | 0.015 | | 0.16 | | 0.10 | |

Notes:
< - Result not detected above laboratory reporting limit.
ug/kg - micrograms per kilogram.
Cpw - the concentration of freely dissolved PAH in porewater
FCV - Final Chronic Value, in organic carbon normalized units (USEPA, 2003).
J - The concentration value is estimated.
JN - The analyte was tentatively identified; the associated numerical value is an estimated quantity with an unknown bias.
NC - Not calculated.
$PAH_{34}$ - Polycyclic Aromatic Hydrocarbons including alkylated PAHs.
U - The target analyte was not detected above the reporting detection limit. Not included in TU calculation.
(a) ΣEqPTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in bold.

**Table 4-13**
**Comparison of Fish Tissue Concentrations to**
**Literature-based Critical Body Residue Concentrations**

| COPC (a) | FOD | Detected Concentrations | | | NOEC-based CBR (b) | | LOEC-based CBR (b) | |
|---|---|---|---|---|---|---|---|---|
| | | Minimum | Mean | Maximum | Minimum | Maximum | Minimum | Maximum |
| **INORGANICS** | | | | | | | | |
| Arsenic | 24 : 41 | 0.023 | 0.14 | 0.38 | 0.50 | 5.5 | 1.5 | 11.7 |
| Cadmium | 13 : 41 | 0.0071 | 0.02 | 0.059 | 0.04 | 8.0 | 0.12 | 144 |
| Copper | 41 : 41 | 0.31 | 0.809 | 2 | 1.5 | 8.9 | 2.0 | 20.3 |
| Lead | 36 : 41 | 0.034 | 0.41 | 1.5 | 0.3 | 5.1 | 0.40 | 26.2 |
| Mercury | 14 : 40 | 0.019 | 0.12 | 0.67 | 0.3 | 16.0 | 0.27 | 96.8 |
| Nickel | 36 : 41 | 0.12 | 0.48 | 1.2 | NA | NA | 0.20 | 1.2 |
| Selenium | 32 : 41 | 0.27 | 0.349 | 0.44 | 2.1 | 3.8 | NA | NA |
| Silver | 4 : 41 | 0.005 | 0.0061 | 0.0081 | 0.1 | 1.3 | 0.11 | 1.3 |
| Zinc | 41 : 41 | 16 | 27 | 44 | 3.9 | 300.0 | 4.5 | 300 |
| **PESTICIDES** | | | | | | | | |
| 4,4'-DDD | 42 : 42 | 0.0019 | 0.007 | 0.037 | NA | NA | 0.60 | 0.60 |
| 4,4'-DDE | 42 : 42 | 0.0072 | 0.0214 | 0.13 | NA | NA | 0.29 | 44.9 |
| 4,4'-DDT | 42 : 42 | 0.00082 | 0.0044 | 0.021 | 0.26 | 40 | 2.9 | 68.9 |
| Aldrin | 42 : 42 | 0.0004 | 0.00142 | 0.008 | NA | NA | 5.0 | 5.0 |
| Chlordane | 42 : 42 | 0.039 | 0.13 | 0.57 | NA | NA | NA | NA |
| Dieldrin | 41 : 42 | 0.0016 | 0.0061 | 0.021 | 12.8 | 12.8 | 0.26 | 34.0 |
| Endrin | 42 : 42 | 0.0016 | 0.0053 | 0.018 | 0.019 | 1.8 | 0.012 | 2.2 |
| Heptachlor Epoxide | 42 : 42 | 0.001 | 0.0038 | 0.013 | NA | NA | NA | NA |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | | | |
| Total PCBs (Congeners) | 39 : 39 | 0.20 | 0.42 | 1.74 | 0.14 | 4240 | 0.14 | 648 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | |
| Total PAHs (sum 16) | 13 : 36 | 0.0066 | 0.037 | 0.16 | 0.022 | 115 | 0.073 | 33800 |
| **DIOXIN/FURANS** | | | | | | | | |
| TCDD TEQ Fish (c) | 39 : 39 | 1.298E-07 | 1.092E-06 | 9.34733E-06 | 0.000023 | 0.14 | 0.000040 | 2.2 |

Notes:
All concentrations reported in milligrams per kilogram (mg/kg $_{ww}$).
CBR - Critical body residue.
COPC - Constituent of potential concern.
FOD - Frequency of detection.
LOEC - Lowest-observed-effect concentration.
NA - Not available.
NOEC - No-observed-effect concentration.
TCDD TEQ - 2,3,7,8-Dioxin-Toxicity Equivalence.
ww - Wet weight.
(a) Constituents detected in sediment that are potentially bioaccumulative (USEPA, 2000).
(b) The NOEC and LOEC CBRs are identified in Attachment G.
(c) CBRs for 2,3,7,8-TCDD were selected.

## Table 4-14
## Wildlife Exposure Factors

| Receptor Species | Body Weight (kg) | Assumed Diet Fraction of diet as %; Amount as $kg_{ww}$/day Units | Invertebrates | Fish | Food Ingestion Rate ($kg_{dw}$/day) | Food Ingestion Rate ($kg_{ww}$/day) | Fraction Sediment in Diet (%) Amount as $kg_{dw}$/day | Home Range (ha) | Exposure Duration (unitless) |
|---|---|---|---|---|---|---|---|---|---|
| **Piscivores** | | | | | | | | | |
| Great Blue Heron (*Ardea herodias*) | 2.336 (a) | %<br>$kg_{ww}$/day | 6%<br>0.036 (b) | 94%<br>0.546 (b) | 0.145 (c) | 0.583 (d) | 5%<br>0.007 (e) | 4.5 (f) | 1 (g) |
| Belted kingfisher (*Megaceryle alcyon*) | 0.147 (a) | %<br>$kg_{ww}$/day | -- (b)<br>-- | 100%<br>0.093 (b) | 0.023 (c) | 0.093 (d) | 2%<br>0.0005 (e) | 1.65 (f) | 1 (g) |
| Raccoon (*Procyon lotor*) | 5.700 (a) | %<br>$kg_{ww}$/day | 9%<br>0.057 (b) | 91%<br>0.553 (b) | 0.152 (c) | 0.611 (d) | 9.4%<br>0.014 (e) | 156 (f) | 1 (g) |

**General Notes:**

Food ingestion rates are wet weight for food items and dry weight for sediment/soil ingestion. As needed, rate may be converted.
Ingested diet and ingested abiotic media (i.e., soil or sediment) total 100% of dietary ingestion.
See individual organism notes for source, units, and conversion.
Moisture content of food items assumed to be as follows: 76% for invertebrates and 75% for fish (USEPA, 1993).

BW - Body Weight.
FIR - Food Ingestion Rate.
COPC - Constituent of Potential Concern.
ha - hectare.
ww - Wet Weight.
dw - Dry Weight.
USEPA - United States Environmental Protection Agency.

Footnotes for individual species parameters and assumptions presented on next pages.

**Table 4-14**
**Wildlife Exposure Factors**

**Notes for Great Blue Heron (*Ardea herodias*):**

(a) Average body weight of adult male and female herons (USEPA, 1993).
(b) Diet is based on the percentage of stomach contents found in birds in a lower Michigan river (USEPA, 1993).
(c) Food ingestion rate calculated using algorithm for carnivorous birds developed by Nagy, 2001 [FIR ($g_{dw}$/day) = $0.849*BW^{0.663}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Assumption for wading bird based on best professional judgement.
(f) Average feeding territory size based on studies conducted in freshwater marsh and estuary in Oregon (USEPA, 1993).
(g) Great blue heron assumed to be present and actively foraging year-round.

**Notes for Belted Kingfisher (*Megaceryle alcyon*):**

(a) Average body weight of adult male and female kingfishers (USEPA, 1993).
(b) Diet assumed to be exclusively fish based on stomach content and prey item data in streams of Michigan and Nova Scotia (USEPA, 1993).
(c) Food ingestion rate calculated using algorithm for carnivorous birds developed by Nagy, 2001 [FIR ($g_{dw}$/day) = $0.849*BW^{0.663}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Assumption for kingfisher based on best professional judgement.
(f) Average territory (km shoreline) based on studies conducted in streams in Pennsylvania and Ohio (USEPA, 1993).
(g) Belted kingfisher assumed to be present and actively foraging year-round.

**Notes for Raccoon (*Procyon lotor*):**

(a) Average body weight of adult male and female raccoons in Illinois, Missouri, and Alabama studies (USEPA, 1993).
(b) Diet is based on stomach content data for raccoons in Washington tidewater mudflats (USEPA, 1993).
(c) Food ingestion rate calculated using algorithm for omnivorous mammals developed by Nagy, 2001 [FIR ($g_{dw}$/day) = $0.432*BW^{0.678}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Value for raccoon soil consumption (Table 4-4; USEPA, 1993).
(f) Mean of home ranges from Michigan study (USEPA, 1993).
(g) Raccoon assumed to be present and actively foraging year-round.

**Table 4-15**
**Summary of Potential Risks to Wildlife**

| | Hazard Quotients | | | | | |
|---|---|---|---|---|---|---|
| | Maximum EPC | | | | | |
| | Great Blue Heron | | Belted Kingfisher | | Raccoon | |
| **COPC** | **NOAEL-based HQ** | **LOAEL-based HQ** | **NOAEL-based HQ** | **LOAEL-based HQ** | **NOAEL-based HQ** | **LOAEL-based HQ** |
| **INORGANICS** | | | | | | |
| Arsenic | 2.7E-02 | 3.5E-03 | 4.6E-02 | 6.0E-03 | 3.3E-02 | 2.1E-02 |
| Cadmium | 6.5E-03 | 1.5E-03 | 8.9E-03 | 2.1E-03 | 8.3E-03 | 8.3E-04 |
| Chromium | 1.8E-01 | 9.6E-02 | 3.6E-01 | 1.9E-01 | 2.8E-02 | NC |
| Copper | 3.6E-01 | 1.2E-01 | 2.3E-01 | 7.6E-02 | 1.6E-01 | 9.9E-02 |
| Lead | 3.2E-01 | 1.6E-01 | 4.6E-01 | 2.3E-01 | 7.4E-02 | 3.9E-02 |
| Mercury | 4.2E-01 | 1.3E-01 | 1.0E+00 | 3.1E-01 | 5.2E-02 | 1.1E-02 |
| Nickel | 5.0E-02 | 1.8E-02 | 8.3E-02 | 3.0E-02 | 1.2E-01 | 6.2E-02 |
| Selenium | 3.2E-01 | 1.6E-01 | 7.8E-01 | 3.9E-01 | 2.9E-01 | 2.0E-01 |
| Silver | 6.1E-03 | 6.1E-04 | 2.6E-03 | 2.6E-04 | 1.3E-03 | 1.3E-04 |
| Zinc | 1.5E-01 | 5.3E-02 | 3.3E-01 | 1.2E-01 | 6.2E-02 | 1.6E-02 |
| **PESTICIDES** | | | | | | |
| 4,4'-DDD | 7.6E-03 | 7.6E-04 | 2.0E-02 | 2.0E-03 | 5.0E-03 | 1.0E-03 |
| 4,4'-DDE | 1.8E-02 | 1.8E-03 | 4.8E-02 | 4.8E-03 | 1.2E-02 | 2.4E-03 |
| 4,4'-DDT | 7.4E-03 | 7.4E-04 | 1.6E-02 | 1.6E-03 | 6.2E-03 | 1.2E-03 |
| Aldrin | NC | NC | NC | NC | 6.8E-04 | 1.7E-04 |
| alpha-BHC | 3.4E-04 | 8.6E-05 | 9.1E-04 | 2.3E-04 | 5.0E-05 | 2.5E-05 |
| beta-BHC | 3.9E-04 | 9.8E-05 | 9.3E-04 | 2.3E-04 | 2.6E-04 | 5.2E-05 |
| Chlordane | 1.5E-02 | 3.0E-03 | 3.9E-02 | 7.9E-03 | 2.9E-03 | 1.5E-03 |
| delta-BHC | 6.5E-04 | 1.6E-04 | 1.6E-03 | 4.1E-04 | 1.0E-04 | 5.2E-05 |
| Dieldrin | 2.2E-02 | 4.2E-04 | 5.9E-02 | 1.1E-03 | 4.5E-02 | 2.2E-02 |
| Endosulfan II | 4.3E-05 | NC | 1.1E-04 | NC | 1.3E-03 | NC |
| Endrin | 4.0E-03 | 9.9E-04 | 1.0E-02 | 2.6E-03 | 5.5E-03 | 5.5E-04 |
| gamma-BHC (Lindane) | 2.6E-04 | 2.6E-05 | 6.7E-04 | 6.7E-05 | 4.6E-03 | 6.1E-05 |
| Heptachlor | 8.8E-05 | 1.8E-05 | 2.3E-04 | 4.6E-05 | 6.3E-04 | 1.2E-05 |
| Heptachlor Epoxide | NC | NC | NC | NC | 4.2E-03 | 4.2E-04 |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | |
| PCB, Total Aroclors | 3.5E-02 | 8.7E-03 | 9.1E-02 | 2.3E-02 | 1.9E-01 | 3.9E-02 |
| PCB, Total Congeners | 3.7E-01 | 3.7E-02 | 9.2E-01 | 9.2E-02 | 2.3E-02 | 5.8E-03 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | |
| Total High-molecular-weight PAHs | 1.5E-03 | 3.7E-04 | 2.6E-03 | 6.4E-04 | 5.8E-02 | 1.1E-03 |
| Total Low-molecular-weight PAHs | 2.1E-04 | 5.2E-05 | 3.7E-04 | 9.3E-05 | 7.8E-05 | 1.6E-05 |
| **DIOXIN/FURANs** | | | | | | |
| TCDD TEQ Bird | 6.1E-02 | 6.1E-03 | 1.0E-01 | 1.0E-02 | -- | -- |
| TCDD TEQ Mammal | -- | -- | -- | -- | 1.0E-01 | 1.0E-02 |

Notes:
HQs above 1 are bolded and highlighted.

COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
HQ - Hazard Quotient.
LOAEL - Lowest Observed Adverse Effects Level.
NC - Not Calculated. Avian TRV not available.
NOAEL - No Observed Adverse Effect Level.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
TCDD TEQ - Tetrachlorodibenzodioxin Toxic Equivalent.
TRV - Toxicity Reference Value.

**Table 5-1**
**Comparison of Maximum EPCs, BTVs, and Background Evaluation Results**
**for Waterside Investigation Area Surface Sediment**

| COPCs (a) | FOD | Maximum EPC (b) | | Probable Effect ESV (c) | Hazard Quotient (d) | Are Site COPCs Consistent with Background Condition? (e) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum EPC/ Probable Effect ESV | BTV | Maximum EPC/BTV | Are Background Concentrations > Probable-effect ESVs? | Box Plot Analysis | Population Test |
| **INORGANICS** | | | | | | | | | | |
| Antimony | 83 : 84 | 3.4 | 95% KM (Chebyshev) UCL | 3.0 | **1.1** | 0.92 | **3.7** | No | Overlap | Site>=Background |
| Arsenic | 84 : 84 | 5.0 | 95% Approximate Gamma UCL | 33 | 0.15 | -- | -- | -- | -- | -- |
| Barium | 84 : 84 | 90 | 95% Student's-t UCL | 60 | **1.5** | 107 | 0.84 | Yes | Overlap | Site>=Background |
| Beryllium | 84 : 84 | 1.1 | 95% Student's-t UCL | NV | NC | 1.6 | 0.70 | -- | Overlap | Site>=Background |
| Cadmium | 84 : 84 | 1.7 | 95% Chebyshev (Mean, Sd) UCL | 5.0 | 0.34 | -- | -- | -- | -- | -- |
| Chromium | 84 : 84 | 42 | 95% Approximate Gamma UCL | 111 | 0.38 | -- | -- | -- | -- | -- |
| Copper | 84 : 84 | 74 | 95% Chebyshev(Mean, Sd) UCL | 149 | 0.50 | -- | -- | -- | -- | -- |
| Cyanide | 15 : 20 | 0.99 | KM H-UCL | 0.1 (f) | **10** | 0.99 | 1.0 | Yes | Overlap | Site>=Background |
| Iron | 84 : 84 | 22058 | 95% Modified-t UCL | 40000 | 0.55 | -- | -- | -- | -- | -- |
| Lead | 84 : 84 | 99 | 95% Chebyshev(Mean, Sd) UCL | 128 | 0.77 | -- | -- | -- | -- | -- |
| Manganese | 84 : 84 | 299 | 95% Approximate Gamma UCL | 1100 | 0.27 | -- | -- | -- | -- | -- |
| Mercury | 84 : 84 | 0.22 | 95% Approximate Gamma UCL | 1.1 | 0.21 | -- | -- | -- | -- | -- |
| Nickel | 84 : 84 | 52 | 95% Chebyshev(Mean, Sd) UCL | 48.6 | **1.1** | 40 | **1.3** | No | Overlap | Site>=Background |
| Silver | 84 : 84 | 0.79 | 95% Chebyshev(Mean, Sd) UCL | 4.5 | 0.18 | -- | -- | -- | -- | -- |
| Thallium | 84 : 84 | 0.22 | 95% Approximate Gamma UCL | NV | NC | 0.31 | 0.7 | -- | Overlap | Site>=Background |
| Vanadium | 84 : 84 | 93 | 95% Chebyshev (Mean, Sd) UCL | NV | NC | 43 | **2.1** | -- | Overlap | Site>=Background |
| Zinc | 84 : 84 | 244 | 95% Approximate Gamma UCL | 459 | 0.53 | -- | -- | -- | -- | -- |
| **PESTICIDES** | | | | | | | | | | |
| 4,4'-DDD | 49 : 49 | 0.012 | 95% Chebyshev(Mean, Sd) UCL | 0.028 | 0.42 | -- | -- | -- | -- | -- |
| 4,4'-DDE | 48 : 49 | 0.011 | KM H-UCL | 0.031 | 0.36 | -- | -- | -- | -- | -- |
| 4,4'-DDT | 33 : 49 | 0.17 | 95% KM (Chebyshev) UCL | 0.063 | **2.7** | 0.0028 | **60** | Yes | Overlap | Site>=Background |
| Aldrin | 30 : 49 | 0.00076 | KM H-UCL | 0.040 | 0.019 | -- | -- | -- | -- | -- |
| cis-Chlordane | 29 : 29 | 0.0090 | 95% Student's-t UCL | 0.018 | 0.51 | -- | -- | -- | -- | -- |
| Dieldrin | 39 : 49 | 0.0049 | 95% GROS Adjusted Gamma UCL | 0.062 | 0.079 | -- | -- | -- | -- | -- |
| Endosulfan Sulfate | 30 : 48 | 0.0022 | Gamma Adjusted KM-UCL | 0.0054 (f) | 0.41 | -- | -- | -- | -- | -- |
| Endrin | 36 : 49 | 0.0074 | 95% GROS Adjusted Gamma UCL | 0.21 | 0.036 | -- | -- | -- | -- | -- |
| Endrin ketone | 12 : 28 | 0.0022 | 95% KM (t) UCL | 0.21 | 0.011 | -- | -- | -- | -- | -- |
| Chlordane (technical) | 14 : 15 | 0.071 | 95% KM Adjusted Gamma UCL | 0.018 | **4.1** | 0.12 | 0.6 | Yes | Overlap | Site < Background |
| Heptachlor Epoxide | 46 : 49 | 0.0022 | KM H-UCL | 0.016 | 0.14 | -- | -- | -- | -- | -- |
| Methoxychlor | 14 : 28 | 0.0093 | 95% KM (t) UCL | 0.059 | 0.16 | -- | -- | -- | -- | -- |
| trans-Chlordane | 24 : 29 | 0.014 | 95% KM (Chebyshev) UCL | 0.018 | 0.78 | -- | -- | -- | -- | -- |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | -- | | | | |
| PCB, Total Congeners | 32 : 32 | 2.5 | 95% Chebyshev (Mean, Sd) UCL | 0.68 | **3.8** | 0.42 | **6.0** | No | Site > Background | Site>=Background |
| PCB, Total Aroclors | 83 : 84 | 0.48 | KM H-UCL | 0.68 | 0.70 | 0.18 | **2.6** | No | Site > Background | Site>=Background |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | -- | | | | |
| 4-Chloroaniline | 2 : 14 | 8.20E-02 | NC | 0.021 | **3.9** | NC | NC | No | NC | NC |
| 4-Methylphenol | 6 : 14 | 0.096 | 95% KM (t) UCL | 0.0051 (f) | **19** | NC | NC | Yes | NC | NC |
| Acetophenone | 6 : 14 | 0.038 | 95% KM (t) UCL | NV | NC | -- | -- | -- | -- | -- |
| Benzaldehyde | 11 : 13 | 0.19 | 95% KM (t) UCL | 0.58 | 0.33 | -- | -- | -- | -- | -- |
| Benzoic acid | 10 : 20 | 0.78 | 95% KM (t) UCL | 2 | 0.39 | -- | -- | -- | -- | -- |
| bis-(2-Ethylhexyl)phthalate | 34 : 34 | 2.7 | 95% Chebyshev(Mean, Sd) UCL (j) | 0.75 | **3.7** | 2.3 | **1.2** | Yes | Overlap | Site>=Background |
| Butylbenzylphthalate | 17 : 34 | 0.47 | 95% KM (Chebyshev) UCL | 0.481 | 1.0 | -- | -- | -- | -- | -- |
| Caprolactam | 1 : 14 | 0.39 | Maximum Detected Value | NV | NC | -- | -- | -- | -- | -- |
| Carbazole | 14 : 14 | 0.13 | 95% Adjusted Gamma UCL | 4.6 | 0.029 | -- | -- | No | -- | -- |
| Di-n-octylphthalate | 7 : 34 | 0.11 | 95% KM (t) UCL | 0.10 (f) | **1.1** | NC | NC | Yes | NC | NC |
| Total High-molecular-weight PAHs | 68 : 69 | 8.6 | 95% KM (Chebyshev) UCL | 6.5 | **1.3** | 19 | 0.4 | No | Site < Background | Site < Background |
| Total Low-molecular-weight PAHs | 67 : 69 | 1.3 | KM H-UCL | 5.3 | 0.24 | -- | -- | -- | -- | -- |
| Total PAHs (sum 16) | 68 : 69 | 9.7 | 95% KM (Chebyshev) UCL | 22.8 | 0.43 | -- | -- | -- | -- | -- |
| **SVOCs (method ID0016)** | | | | | | -- | | | | |
| 2,3,5-Trimethylnaphthalene | 22 : 22 | 0.10 | 95% Adjusted Gamma UCL | NV | NC | 0.028 | **3.4** | -- | Site > Background | NC |
| 2,6-Dimethylnaphthalene | 22 : 22 | 0.13 | 95% Adjusted Gamma UCL | NV | NC | 0.035 | **3.8** | -- | Site > Background | NC |
| Total High-molecular-weight PAHs | 39 : 39 | 11 | 95% Student's-t UCL | 6.5 | **1.7** | 17 | 0.6 | Yes | Overlap | Site>=Background |
| Total Low-molecular-weight PAHs | 39 : 39 | 1.3 | KM H-UCL | 5.3 | 0.24 | -- | -- | -- | -- | -- |
| Total PAHs (sum 16) | 39 : 39 | 10 | 95% KM (Chebyshev) UCL | 23 | 0.43 | -- | -- | -- | -- | -- |

**Table 5-1**
**Comparison of Maximum EPCs, BTVs, and Background Evaluation Results**
**for Waterside Investigation Area Surface Sediment**

| COPCs (a) | FOD | Maximum EPC (b) | | Probable Effect ESV (c) | Hazard Quotient (d) | Are Site COPCs Consistent with Background Condition? (e) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum EPC/ Probable Effect ESV | BTV | Maximum EPC/BTV | Are Background Concentrations > Probable-effect ESVs? | Box Plot Analysis | Population Test |
| **DIOXIN/FURANS** | | | | | | -- | | | | |
| 2,3,7,8-TCDD | 34 : 41 | 1.1E-05 | KM H-UCL | NV | NC | 6.8E-07 | **16** | -- | Overlap | Site>=Background |
| 1,2,3,7,8-PeCDD | 39 : 41 | 4.8E-05 | 95% KM (Chebyshev) UCL | NV | NC | 2.2E-06 | **22** | -- | Overlap | Site>=Background |
| 1,2,3,6,7,8-HxCDD | 41 : 41 | 9.9E-05 | 95% Chebyshev (Mean, Sd) UCL | NV | NC | 1.4E-05 | **7.3** | -- | Overlap | Site>=Background |
| 1,2,3,4,7,8-HxCDD | 39 : 41 | 5.3E-05 | 95% KM (Chebyshev) UCL | NV | NC | 4.8E-06 | **11.0** | -- | Overlap | Site>=Background |
| 1,2,3,7,8,9-HxCDD | 40 : 41 | 1.3E-04 | 95% KM (Chebyshev) UCL | NV | NC | 1.5E-05 | **8.5** | -- | Overlap | Site>=Background |
| 1,2,3,4,6,7,8-HpCDD | 41 : 41 | 7.9E-04 | 95% Chebyshev(Mean, Sd) UCL (j) | NV | NC | 3.8E-04 | **2.1** | -- | Overlap | Site>=Background |
| OCDD | 41 : 41 | 4.6E-03 | 95% Adjusted Gamma UCL | NV | NC | 1.3E-02 | 0.4 | -- | Overlap | Site < Background |
| 2,3,7,8-TCDF | 40 : 41 | 1.1E-05 | KM H-UCL | NV | NC | 3.1E-06 | **3.6** | -- | Overlap | Site>=Background |
| 1,2,3,7,8-PeCDF | 38 : 41 | 2.3E-05 | 95% KM (Chebyshev) UCL | NV | NC | 1.8E-06 | **13** | -- | Overlap | Site>=Background |
| 2,3,4,7,8-PeCDF | 38 : 41 | 4.3E-05 | 95% KM (Chebyshev) UCL | NV | NC | 2.6E-06 | **17** | -- | Overlap | Site>=Background |
| 1,2,3,6,7,8-HxCDF | 36 : 41 | 5.0E-05 | 95% KM (Chebyshev) UCL | NV | NC | 3.3E-06 | **15** | -- | Overlap | Site>=Background |
| 1,2,3,7,8,9-HxCDF | 27 : 41 | 4.4E-06 | 95% KM (Chebyshev) UCL | NV | NC | NC | NC | -- | Overlap | Site>=Background |
| 1,2,3,4,7,8-HxCDF | 39 : 41 | 8.7E-05 | 95% KM (Chebyshev) UCL | NV | NC | 7.2E-06 | **12** | -- | Overlap | Site>=Background |
| 2,3,4,6,7,8-HxCDF | 39 : 41 | 5.3E-05 | 95% KM (Chebyshev) UCL | NV | NC | 3.8E-06 | **14** | -- | Overlap | Site>=Background |
| 1,2,3,4,6,7,8-HpCDF | 41 : 41 | 2.0E-04 | 95% Chebyshev(Mean, Sd) UCL (j) | NV | NC | 4.7E-05 | **4.3** | -- | Overlap | Site>=Background |
| 1,2,3,4,7,8,9-HpCDF | 37 : 41 | 2.8E-05 | 95% KM (Chebyshev) UCL | NV | NC | 3.0E-06 | **9.2** | -- | Overlap | Site>=Background |
| OCDF | 39 : 41 | 1.6E-04 | KM H-UCL | NV | NC | 9.2E-05 | **1.7** | -- | Overlap | Site>=Background |

Notes:
All concentrations reported in milligrams per kilogram (mg/kg).
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
ESV - Ecological Screening Value.
FOD - Frequency of Detection (samples detected : total number of samples).
KM Mean - Kaplan-Meier Mean.
NC - Not Calculated.
NV - No Value.
OMOE - Ontario Ministry of Environment and Energy.
PAH - Polycyclic Aromatic Hydrocarbon.
PCB - Polychlorinated biphenyls.
SVOCs - Semi-volatile Organic Compounds.
SQuiRTs - Screening Quick Reference Tables.
UCL - Upper Confidence Level.
USEPA - United States Environmental Protection Agency.
VOCs - Volatile Organic Compounds.

(a) Sediment COPCs identified in Table 4-2 are presented.
(b)The maximum exposure point concentration (EPC) is the recommended UCL, or the maximum detected concentration if a UCL could not be calculated. See Attachment B Table 1 for selection of EPCs.
(c) Probable effect ESVs are based on the Probable Effects Concentrations (MacDonald et al. 2000), or either the Upper Effects Thresholds (UET) or Severe Effect Level (SEL) if the UET was not available (Buchman, 2008), and USEPA Region 4 recommended refined Screening Value (USEPA, 2018).
(d) Hazard quotients are calculated by dividing the EPC by the ESV. Hazard quotients greater than 1 are in bold and highlighted.
(e) Background Data Evaluation is presented in Appendix X of the RI Report.
(f) Probable effect ESV is not available. The EPC is divided by the low effect ESV for comparison.

**Table 5-2**
**Summary of Sediment Chemistry, Toxicity, Bioavailability, and Community**

| | | Site Samples | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Channel |
| Sample Location | | SED6.5D | SED6.5E | SED7.5D | SED7.5E | SED7D | SED7E | SED7F | SED6A |
| **Parameter** | Units | | | | | | | | |
| **Sediment Toxicity Results (a)** | | | | | | | | | |
| Amphipod - mean survival | % | 95.0 | 96.3 | 96.3 | 98.8 | 93.8 | 93.8 | 96.3 | 95.0 |
| Amphipod - mean dry weight | mg | 0.15 | 0.15 | ***0.14*** | ***0.14*** | 0.15 | ***0.13*** | ***0.14*** | ***0.13*** |
| Midge - mean survival | % | **82.5** | 90.0 | 87.5 | 92.5 | 88.8 | 93.8 | 87.5 | 87.5 |
| Midge - mean dry weight | mg | 1.79 | *1.90* | 1.72 | **1.64** | *1.88* | 1.79 | *1.87* | *1.93* |
| **Macroinvertebrate Community Survey Results (b)** | | | | | | | | | |
| B-IBI | unitless | 3.00 | 2.83 | 3.17 | 3.00 | 3.00 | 2.67 | **2.33** | **2.33** |
| **PEC-Q (c)** | | | | | | | | | |
| Mean metals PEC-Q (d) | unitless | 0.54 | 0.57 | 0.60 | 0.94 | 0.48 | 0.46 | 0.74 | 0.31 |
| 4,4'-DDE PEC-Q | unitless | 0.19 | 0.20 | 0.20 | 0.32 | 0.27 | 0.14 | 0.16 | 0.21 |
| Total PCB Aroclors PEC-Q | unitless | 0.24 | 0.37 | 0.80 | **1.2** | 0.078 | 0.93 | 0.44 | 0.10 |
| Total PCB congeners PEC-Q | unitless | | | | **2.1** | | | **1.5** | 0.27 |
| **Bioavailability of PAHs (e)** | | | | | | | | | |
| ΣEqPTU Porewater | unitless | 0.10 | 0.51 | 0.021 | 0.11 | 0.013 | 0.16 | 0.12 | 0.011 |
| ∑ESBTU Sediment | unitless | 0.28 | 0.38 | **1.14** | 0.36 | 0.39 | 0.55 | 0.50 | 0.24 |
| **Bioavailability of Divalent Metals (f)** | | | | | | | | | |
| [Sum SEM - AVS]/$f_{oc}$ | umol/goc | 54 | -29 | 101 | -214 | 82 | -34 | 100 | -77 |
| **Physical Properties** | | | | | | | | | |
| Percent gravel | % | 5.2 | 6.6 | 1.0 | 0.0 | 0.3 | 4.6 | 0 | 0 |
| Percent sand | % | 57.2 | 52.8 | 18.9 | 40.7 | 18 | 64.2 | 49.9 | 44.7 |
| Percent silt | % | 27.7 | 17.9 | 56.4 | 48.4 | 62.8 | 25.5 | 41.2 | 37.9 |
| Percent clay | % | 9.9 | 9.5 | 23.7 | 10.9 | 18.9 | 5.7 | 8.9 | 17.4 |
| Percent fines (g) | % | 37.6 | 27.4 | 80.1 | 59.3 | 81.7 | 31.2 | 50.1 | 55.3 |
| Total Organic Carbon | % | 6.5 | 7.0 | 5.0 | 9.4 | 5.8 | 4.5 | 5.8 | 8.3 |

Notes
% - Percent.
ft - Feet.
umol/goc - micromole per gram organic carbon
PEC-Q - Probable effect concentration quotient.

(a) Sediment toxicity test results are provided in Tables 4-5 and 4-6.
***BOLD*** - Statistically significant reduction ($p<0.05$) relative to group-specific lab control.
*Italics* - Statistically significant reduction ($p<0.05$) relative to 1-2 background samples.
Gray Shading - Statistically significant reduction ($p<0.05$) relative to 3-4 background samples.
(b) Benthic Index of Biotic Integrity presented on Table 4-7.
**BOLD** - Values equal to 2.6 or less are considered degraded.
(c) Calculated as the concentration divided by the PEC. Values greater than 1, indicating the concentration is greater than the PEC, are in bold.
(d) Mean metals PEC-Q is calculated as the average of individual metal PEC-Qs for arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.
(e) ΣESBTU and ΣEqPTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in **BOLD**.
(f) Bioavailability of divalent metals is presented in Table 4-4.
If the (∑SEM-AVS)/foc is less than 130 μmol/goc, the sediments are presumed to "not likely" be toxic.
(g) Percent fines is calculated as the sum of percent silt and percent clay.

**Table 5-2**
**Summary of Sediment Chemistry, Toxicity, Bioavailability, and Community**

| | | Site Samples | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Area** | Site - Channel | Site - Channel | Site - Channel | Site - Channel | Site - Channel | Site - Channel | Site - Channel |
| | **Sample Location** | SED6B | SED6C | SED7A | SED7B | SED8A | SED8B | SED8C |
| **Parameter** | Units | | | | | | | |
| **Sediment Toxicity Results (a)** | | | | | | | | |
| Amphipod - mean survival | % | 93.8 | 96.3 | 93.8 | *90.0* | 98.8 | 96.3 | 97.5 |
| Amphipod - mean dry weight | mg | 0.15 | **0.14** | 0.14 | **0.13** | ***0.13*** | 0.14 | ***0.14*** |
| Midge - mean survival | % | 92.5 | 91.3 | 87.5 | 88.8 | 85.0 | 88.8 | 85.0 |
| Midge - mean dry weight | mg | *1.84* | 1.74 | *1.87* | **1.41** | *1.96* | *1.88* | 1.73 |
| **Macroinvertebrate Community Survey Results (b)** | | | | | | | | |
| B-IBI | unitless | 2.83 | 2.67 | 3.17 | 2.83 | **2.33** | 3.50 | **1.83** |
| **PEC-Q (c)** | | | | | | | | |
| Mean metals PEC-Q (d) | unitless | 0.20 | 0.44 | 0.46 | 0.44 | 0.41 | 0.36 | 0.37 |
| 4,4'-DDE PEC-Q | unitless | 0.13 | 0.65 | 0.18 | **1.3** | 0.20 | 0.13 | 0.42 |
| Total PCB Aroclors PEC-Q | unitless | 0.19 | 0.43 | 0.10 | 0.70 | 0.09 | 0.049 | 0.38 |
| Total PCB congeners PEC-Q | unitless | 0.31 | | | | | | |
| **Bioavailability of PAHs (e)** | | | | | | | | |
| ΣEqPTU Porewater | unitless | 0.013 | 0.14 | 0.056 | **1.80** | 0.015 | 0.16 | 0.10 |
| ∑ESBTU Sediment | unitless | 0.78 | 0.18 | 0.23 | **1.11** | 0.29 | 0.23 | 0.47 |
| **Bioavailability of Divalent Metals (f)** | | | | | | | | |
| [Sum SEM - AVS]/$f_{oc}$ | umol/goc | 45 | 31 | 44 | 34 | 49 | 54 | 7.0 |
| **Physical Properties** | | | | | | | | |
| Percent gravel | % | 0 | 4.6 | 2.5 | 0 | 1.7 | 6 | 3.5 |
| Percent sand | % | 59 | 11.8 | 18.3 | 3.1 | 8.3 | 59.7 | 18.9 |
| Percent silt | % | 30.1 | 55 | 51.4 | 59.2 | 61.3 | 21 | 55.9 |
| Percent clay | % | 10.9 | 28.6 | 27.8 | 37.7 | 28.7 | 13.3 | 21.7 |
| Percent fines (g) | % | 41 | 83.6 | 79.2 | 96.9 | 90 | 34.3 | 77.6 |
| Total Organic Carbon | % | 2.1 | 9.6 | 7.9 | 3.1 | 6.6 | 6.7 | 4.4 |

Notes
% - Percent.
ft - Feet.
umol/goc - micromole per gram organic carbon
PEC-Q - Probable effect concentration quotient.

(a) Sediment toxicity test results are provided in Tables 4-5 and 4-6.
***BOLD*** - Statistically significant reduction (p<0.05) relative to group-specific lab control.
*Italics* - Statistically significant reduction (p<0.05) relative to 1-2 background samples.
Gray Shading - Statistically significant reduction (p<0.05) relative to 3-4 background samples.
(b) Benthic Index of Biotic Integrity presented on Table 4-7.
**BOLD** - Values equal to 2.6 or less are considered degraded.
(c) Calculated as the concentration divided by the PEC. Values greater than 1, indicating the concentration is greater than the PEC, are in bold.
(d) Mean metals PEC-Q is calculated as the average of individual metal PEC-Qs for arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.
(e) ΣESBTU and ΣEqPTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in **BOLD**.
(f) Bioavailability of divalent metals is presented in Table 4-4.
If the (∑SEM-AVS)/foc is less than 130 μmol/goc, the sediments are presumed to "not likely" be toxic.
(g) Percent fines is calculated as the sum of percent silt and percent clay.

Table 5-2
Summary of Sediment Chemistry, Toxicity, Bioavailability, and Community

| | | Background Samples | | | | |
|---|---|---|---|---|---|---|
| Area | | Background | Background | Background | Background | Background |
| Sample Location | | SEDBACK16 | SEDBACK17 | SEDBACK18 | SEDBACK19 | SEDBACK20 |
| Parameter | Units | | | | | |
| **Sediment Toxicity Results (a)** | | | | | | |
| Amphipod - mean survival | % | **83.8** | 96.3 | 97.5 | 97.5 | 91.3 |
| Amphipod - mean dry weight | mg | **0.11** | 0.15 | 0.15 | 0.14 | 0.15 |
| Midge - mean survival | % | **83.8** | 90.0 | 86.3 | 90.0 | 85.0 |
| Midge - mean dry weight | mg | 2.37 | 1.80 | 2.05 | 1.92 | 2.09 |
| **Macroinvertebrate Community Survey Results (b)** | | | | | | |
| B-IBI | unitless | 2.67 | **1.67** | **1.83** | **2.17** | **1.83** |
| **PEC-Q (c)** | | | | | | |
| Mean metals PEC-Q (d) | unitless | 0.31 | 0.32 | 0.20 | 0.22 | 0.22 |
| 4,4'-DDE PEC-Q | unitless | 0.10 | 0.14 | 0.06 | 0.03 | 0.08 |
| Total PCB Aroclors PEC-Q | unitless | 0.21 | 0.067 | 0.033 | 0.11 | 0.08 |
| Total PCB congeners PEC-Q | unitless | 0.06 | 0.56 | 0.055 | 0.21 | 0.09 |
| **Bioavailability of PAHs (e)** | | | | | | |
| ΣEqPTU Porewater | unitless | 0.013 | 0.009 | 0.009 | 0.011 | 0.006 |
| ∑ESBTU Sediment | unitless | 0.25 | 0.27 | 0.29 | 0.45 | 0.13 |
| **Bioavailability of Divalent Metals (f)** | | | | | | |
| [Sum SEM - AVS]/$f_{oc}$ | umol/goc | -15 | 13 | 14 | 89 | -0.72 |
| **Physical Properties** | | | | | | |
| Percent gravel | % | 12.1 | 18.2 | 11.7 | 8.3 | 0.0 |
| Percent sand | % | 47.5 | 32.1 | 51.5 | 20.7 | 82.7 |
| Percent silt | % | 27.2 | 39.1 | 30.3 | 5.5 | 10.4 |
| Percent clay | % | 13.2 | 10.6 | 6.5 | 1.9 | 6.9 |
| Percent fines (g) | % | 40.4 | 49.7 | 36.8 | 7.4 | 17.3 |
| Total Organic Carbon | % | 14 | 8.0 | 2.9 | 1.6 | 5.1 |

Notes
% - Percent.
ft - Feet.
umol/goc - micromole per gram organic carbon
PEC-Q - Probable effect concentration quotient.

(a) Sediment toxicity test results are provided in Tables 4-5 and 4-6.
***BOLD*** - Statistically significant reduction ($p<0.05$) relative to group-specific lab control.
*Italics* - Statistically significant reduction ($p<0.05$) relative to 1-2 background samples.
Gray Shading - Statistically significant reduction ($p<0.05$) relative to 3-4 background samples.
(b) Benthic Index of Biotic Integrity presented on Table 4-7.
**BOLD** - Values equal to 2.6 or less are considered degraded.
(c) Calculated as the concentration divided by the PEC. Values greater than 1, indicating the concentration is greater than the PEC, are in bold.
(d) Mean metals PEC-Q is calculated as the average of individual metal PEC-Qs for arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.
(e) ΣESBTU and ΣEqPTU calculated based on the sum of PAH34 TUs. Values greater than 1 are in **BOLD**.
(f) Bioavailability of divalent metals is presented in Table 4-4.
If the (∑SEM-AVS)/foc is less than 130 µmol/goc, the sediments are presumed to "not likely" be toxic.
(g) Percent fines is calculated as the sum of percent silt and percent clay.

**Table 5-3**
**Sediment Sample-by-Sample Screen:**
**2017 Waterside Investigation Area and Background Samples**

| | | | | Site Samples | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Area** | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Cove |
| | | | **Location** | SED6.5D | SED6.5E | SED7.5D | SED7.5E | SED7D | SED7E |
| | | | **Sample** | SED6.5D00EN | SED6.5E00EN | SED7.5D00EN | SED7.5E00EN | SED7D00EN | SED7E00EN |
| | | | **Sample Date** | 6/9/2017 | 6/8/2017 | 6/9/2017 | 6/8/2017 | 6/9/2017 | 6/8/2017 |
| | | | **Depth Interval** | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | | | | | |
| **Metals** | | | | | | | | | |
| Antimony | 2 | 3 | mg/kg | 1.3 | **2.8** | 1.7 | **2.3** | 1.1 | 1.1 |
| Barium | 0.7 | 60 | mg/kg | **81** | **70** | **110** | **110** | **97** | **52** |
| Beryllium | NV | NV | mg/kg | 1.1 | 0.89 | 1.6 | 1.1 | 1.4 | 0.51 |
| Cadmium | 0.58 | 5.0 | mg/kg | **2.5** | **2.4** | **2** | **3.3** | **1.5** | **1.7** |
| Iron | 20000 | 40000 | mg/kg | 20000 | 17000 | **29000** | **25000** | **28000** | 13000 |
| Lead | 31 | 128 | mg/kg | **99** | **160** | **97** | **140** | **71** | **76** |
| Manganese | 460 | 1100 | mg/kg | 190 | 160 | 250 | 190 | 270 | 100 |
| Mercury | 0.174 | 1.06 | mg/kg | **0.26** | **0.23** | **0.3** | **0.44** | **0.29** | **0.18** |
| Nickel | 16 | 48.6 | mg/kg | **47** | **47** | **57** | **97** | **46** | **56** |
| Silver | 0.5 | 4.5 | mg/kg | **0.99** | **0.63** | **0.82** | **1.3** | 0.45 | **0.55** |
| Thallium | NV | NV | mg/kg | 0.22 | 0.18 | 0.26 | 0.27 | 0.24 | 0.13 |
| Vanadium | NV | NV | mg/kg | 63 | 77 | 88 | 160 | 56 | 110 |
| Zinc | 98 | 459 | mg/kg | **340** | **340** | **410** | **600** | **320** | **280** |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 0.00354 | 0.028 | mg/kg | **0.0044 J** | **0.0040 J** | 0.0035 J | **0.0044 J** | 0.0032 J | 0.0035 J |
| 4,4'-DDE | 0.00316 | 0.0313 | mg/kg | **0.0058 J** | **0.0061 J** | **0.0061 J** | **0.01 J** | **0.0083** | **0.0042 J** |
| 4,4'-DDT | 0.00119 | 0.0629 | mg/kg | < 0.00093 U | < 0.0010 U | < 0.00098 U | < 0.0012 U | < 0.0010 U | < 0.00073 U |
| Aldrin | 0.002 | 0.04 | mg/kg | < 0.00093 U | < 0.0010 U | < 0.00098 U | < 0.0012 U | < 0.0010 U | 0.00013 J |
| cis-Chlordane | 3.00E-05 | 0.0176 | mg/kg | **0.0078** | **0.0086** | **0.0094** | **0.0096** | **0.0099** | **0.0077** |
| Dieldrin | 0.0019 | 0.0618 | mg/kg | < 0.00093 U | < 0.0010 U | < 0.00098 U | < 0.0012 U | **0.0020 J** | < 0.00073 U |
| Endosulfan Sulfate | 0.0054 | NV | mg/kg | < 0.00093 U | < 0.0010 U | < 0.00098 U | < 0.0012 U | < 0.0010 U | < 0.00073 U |
| Endrin | 0.00222 | 0.207 | mg/kg | < 0.00093 U | < 0.0010 U | < 0.00098 U | < 0.0012 U | < 0.0010 U | < 0.00073 U |
| Endrin ketone | 0.00222 | 0.207 | mg/kg | < 0.00093 U | < 0.0010 U | < 0.00098 U | < 0.0012 U | < 0.0010 U | < 0.00073 U |
| Heptachlor Epoxide | 0.0006 | 0.016 | mg/kg | **0.0012 J** | **0.0023 J** | **0.0018 J** | **0.0049 J** | **0.0012 J** | **0.0041 J** |
| Methoxychlor | 0.0187 | 0.059 | mg/kg | < 0.00093 U | < 0.0010 U | < 0.00098 U | < 0.0012 U | < 0.0010 U | < 0.00073 U |
| trans-Chlordane | 3.00E-05 | 0.0176 | mg/kg | **0.0082** | < 0.0010 U | **0.0095** | < 0.0012 U | **0.0093** | < 0.00073 U |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | |
| PCB, Total Aroclors | 0.026 | 0.676 | mg/kg | **0.16** | **0.25** | **0.54** | **0.78** | **0.053** | **0.63** |
| PCB, Total Congeners | 0.026 | 0.676 | mg/kg | | | | **1.4** | | |
| **Semi-Volatile Organic Compounds (SVOCs via Method ID0016)** | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | NV | NV | mg/kg | 0.052 | 0.096 | 0.076 | 0.088 | 0.029 | 0.075 |
| 2,6-Dimethylnaphthalene | NV | NV | mg/kg | 0.098 | 0.14 | 0.09 | 0.18 | 0.058 | 0.13 |
| Total High-molecular-weight PAHs | 0.193 | 6.5 | mg/kg | **7.6** | **9** | **12** | **14** | **12** | **11** |
| Total Low-molecular-weight PAHs | 0.07642 | 5.3 | mg/kg | **0.73** | **0.92** | **1.3** | **1.4** | **0.74** | **1.2** |
| Total PAHs (sum 16) | 0.2641 | 22.8 | mg/kg | **8.3** | **10** | **13** | **16** | **13** | **12** |
| **DioxinFurans** | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | NV | NV | mg/kg | 0.0000233 | 0.0000658 | 0.0000936 | 0.0000667 | 0.000051 | 0.0000611 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.0000974 | 0.000237 | 0.000382 | 0.000244 | 0.000254 | 0.000204 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | NV | NV | mg/kg | 0.00000216 | 0.00000766 | 0.000012 | 0.00000779 | 0.0000052 | 0.0000062 |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.0000049 | 0.0000162 | 0.0000186 | 0.0000121 | 0.00000871 | 0.0000114 |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000459 | 0.0000148 | 0.0000196 | 0.0000145 | 0.0000096 | 0.0000104 |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.00000537 | 0.0000174 | 0.0000208 | 0.0000149 | 0.00001 | 0.000012 |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000894 | 0.0000269 | 0.00004 | 0.0000264 | 0.0000201 | 0.0000211 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000385 JN | 0.00000253 J | 0.000001 J | 0.00000119 J | 0.000000961 J | 0.00000195 |

## Table 5-3
## Sediment Sample-by-Sample Screen:
## 2017 Waterside Investigation Area and Background Samples

| | | | | Site Samples | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Area | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Cove | Site - Cove |
| | | | Location | SED6.5D | SED6.5E | SED7.5D | SED7.5E | SED7D | SED7E |
| | | | Sample | SED6.5D00EN | SED6.5E00EN | SED7.5D00EN | SED7.5E00EN | SED7D00EN | SED7E00EN |
| | | | Sample Date | 6/9/2017 | 6/8/2017 | 6/9/2017 | 6/8/2017 | 6/9/2017 | 6/8/2017 |
| | | | Depth Interval | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000744 | 0.0000235 | 0.0000324 | 0.0000211 | 0.0000165 | 0.0000173 |
| 1,2,3,7,8-PeCDF | NV | NV | mg/kg | 0.00000313 J | 0.0000105 J | 0.0000101 J | 0.00000729 J | 0.00000454 J | 0.00000609 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000443 | 0.0000154 | 0.0000184 | 0.0000135 | 0.00000879 | 0.0000101 |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.00000704 | 0.0000222 | 0.0000295 | 0.00002 | 0.0000139 | 0.0000189 |
| 2,3,4,7,8-Pentachlorodibenzofuran | NV | NV | mg/kg | 0.00000682 J | 0.0000212 J | 0.0000263 J | 0.0000201 J | 0.0000137 J | 0.0000227 J |
| 2,3,7,8-Tetrachlorodibenzofuran | NV | NV | mg/kg | 0.00000229 | 0.00000758 | 0.00000735 | 0.00000524 | 0.00000393 | 0.00000506 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.000000918 | 0.00000305 | 0.00000394 | 0.00000236 | 0.00000165 | 0.00000193 |
| Octachlorochlorodibenzofuran | NV | NV | mg/kg | 0.0000255 | 0.0000839 | 0.000129 | 0.0000957 | 0.0000872 | 0.0000821 |
| Octachlorochlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00107 | 0.00242 | 0.00457 | 0.00203 | 0.00437 | 0.00157 |

Notes:
All concentrations reported in milligrams per kilogram (mg/kg).
Yellow highlighted cells indicate concentrations that are greater than the Low Effect ESV.
Orange highlighted cells indicate concentrations that are greater than the Probable Effect ESV.
ESVs identified on Table 3-1.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
J - Estimated value.
NOAA - National Oceanic and Atmospheric Administration.
NV - No ESV or Effects-based ESV Available.
OMOE - Ontario Ministry of Environment and Energy.
PAH - Polycyclic Aromatic Hydrocarbon.
PCB - Polychlorinated biphenyls.
SQuiRTs - Screening Quick Reference Tables.
U - Not detected.
USEPA - United States Environmental Protection Agency.
(a) Sediment COPCs identified in Table 3-3 are presented. Duplicate samples were resolved by use of the maximum detected concentrations.
(b) Low Effect ESVs selected based on a hierarchy of freshwater values from NOAA SQuiRT tables (Buchman 2008), USEPA Region 3 freshwater sediment screening values (USEPA 2006), USEPA Region 5 Ecological Screening Levels (USEPA 2003), OMOE (Persaud 1993), and USEPA Region 4 recommended ecological screening values (USEPA, 2018).
(c) Probable Effect ESVs are based on the Probable Effects Concentrations (MacDonald et al. 2000), or either the Upper Effects Thresholds (UET) or Severe Effect Level (SEL) if the UET was not available (Buchman, 2008), and and USEPA Region 4 recommended refined Screening Value (USEPA, 2018).

**Table 5-3**
**Sediment Sample-by-Sample Screen:**
**2017 Waterside Investigation Area and Background Samples**

| | | | | Site Samples | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Area** | Site - Cove | Site - Channel | Site - Channel | Site - Channel | Site - Channel | Site - Channel |
| | | | **Location** | SED7F | SED6A | SED6B | SED6C | SED7A | SED7B |
| | | | **Sample** | SED7F00EN | SED6A00EN | SED6B00EN | SED6C00EN | SED7A00EN | SED7B00EN |
| | | | **Sample Date** | 6/8/2017 | 6/8/2017 | 6/8/2017 | 6/7/2017 | 6/9/2017 | 6/7/2017 |
| | | | **Depth Interval** | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | | | | | |
| **Metals** | | | | | | | | | |
| Antimony | 2 | 3 | mg/kg | **43** | 0.82 | 0.42 | 1 | 1.5 | 0.83 |
| Barium | 0.7 | 60 | mg/kg | **87** | **83** | **54** | **110** | **120** | **120** |
| Beryllium | NV | NV | mg/kg | 1 | 1.1 | 0.78 | 1.7 | 1.8 | 1.5 |
| Cadmium | 0.58 | 5.0 | mg/kg | **2.6** | **0.61** | 0.38 | **0.99** | **0.94** | **0.87** |
| Iron | 20000 | 40000 | mg/kg | 20000 | **23000** | 16000 | **33000** | **34000** | **28000** |
| Lead | 31 | 128 | mg/kg | **130** | **43** | **33** | **62** | **59** | **85** |
| Manganese | 460 | 1100 | mg/kg | 200 | 300 | 200 | 430 | **590** | 370 |
| Mercury | 0.174 | 1.06 | mg/kg | **0.36** | **0.18** | 0.095 | **0.24** | **0.23** | **0.47** |
| Nickel | 16 | 48.6 | mg/kg | **75** | **31** | **19** | **42** | **45** | **32** |
| Silver | 0.5 | 4.5 | mg/kg | **1.6** | 0.35 | 0.12 | 0.39 | 0.29 | 0.48 |
| Thallium | NV | NV | mg/kg | 0.2 | 0.18 | 0.12 | 0.24 | 0.24 | 0.23 |
| Vanadium | NV | NV | mg/kg | 140 | 33 | 21 | 48 | 50 | 42 |
| Zinc | 98 | 459 | mg/kg | **470** | **200** | **120** | **290** | **320** | **230** |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 0.00354 | 0.028 | mg/kg | 0.0034 J | 0.0033 J | 0.0018 J | **0.0063 J** | 0.0025 J | **0.0081 J** |
| 4,4'-DDE | 0.00316 | 0.0313 | mg/kg | **0.0051 J** | **0.0065** | **0.0039** | **0.02 J+** | **0.0056** | **0.04** |
| 4,4'-DDT | 0.00119 | 0.0629 | mg/kg | < 0.00096 U | < 0.0012 U | < 0.00082 U | < 0.0013 U | < 0.0012 U | < 0.0011 U |
| Aldrin | 0.002 | 0.04 | mg/kg | < 0.00096 U | < 0.0012 U | < 0.00082 U | < 0.0013 U | < 0.0012 U | 0.00054 J |
| cis-Chlordane | 3.00E-05 | 0.0176 | mg/kg | **0.008** | **0.013** | **0.0066** | **0.01 J** | **0.0067 J** | **0.0018 J** |
| Dieldrin | 0.0019 | 0.0618 | mg/kg | < 0.00096 U | **0.0026 J** | 0.0013 J | **0.0035 J** | **0.0021 J** | < 0.0011 U |
| Endosulfan Sulfate | 0.0054 | NV | mg/kg | < 0.00096 U | < 0.0012 U | < 0.00082 U | R | < 0.0012 U | < 0.0011 U |
| Endrin | 0.00222 | 0.207 | mg/kg | < 0.00096 U | 0.00068 J | < 0.00082 U | < 0.0013 U | < 0.0012 U | < 0.0011 U |
| Endrin ketone | 0.00222 | 0.207 | mg/kg | < 0.00096 U | < 0.0012 U | < 0.00082 U | R | < 0.0012 U | < 0.0011 U |
| Heptachlor Epoxide | 0.0006 | 0.016 | mg/kg | **0.0022 J** | 0.00044 J | 0.00035 J | **0.0011 J** | 0.00041 J | < 0.0011 U |
| Methoxychlor | 0.0187 | 0.059 | mg/kg | < 0.00096 U | < 0.0012 U | < 0.00082 U | R | < 0.0012 U | < 0.0011 U |
| trans-Chlordane | 3.00E-05 | 0.0176 | mg/kg | < 0.00096 U | **0.011** | **0.006** | **0.014** | **0.0094** | < 0.0011 U |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | |
| PCB, Total Aroclors | 0.026 | 0.676 | mg/kg | **0.3** | **0.069** | **0.13** | **0.29** | **0.067** | **0.47** |
| PCB, Total Congeners | 0.026 | 0.676 | mg/kg | **1** | **0.18** | **0.21** | | | |
| **Semi-Volatile Organic Compounds (SVOCs via Method ID0016)** | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | NV | NV | mg/kg | 0.06 | 0.013 J | 0.015 J | 0.026 | 0.014 J | 0.39 |
| 2,6-Dimethylnaphthalene | NV | NV | mg/kg | 0.13 | 0.022 J | 0.063 | 0.039 | 0.03 | 0.3 |
| Total High-molecular-weight PAHs | 0.193 | 6.5 | mg/kg | **11** | **11** | **8.8** | **8.6** | **9.6** | **7.7** |
| Total Low-molecular-weight PAHs | 0.07642 | 5.3 | mg/kg | **1.1** | **0.78** | **0.69** | **0.65** | **0.79** | **1.7** |
| Total PAHs (sum 16) | 0.2641 | 22.8 | mg/kg | **12** | **12** | **9.5** | **9.3** | **10** | **9.4** |
| **DioxinFurans** | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | NV | NV | mg/kg | 0.0000492 | 0.00000656 | 0.00000479 | 0.0000251 | 0.0000206 | 0.0000314 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.000166 | 0.0000435 | 0.0000382 | 0.000143 | 0.000154 | 0.000061 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | NV | NV | mg/kg | 0.00000558 | 0.000000535 J | 0.00000037 J | 0.00000214 JN | 0.00000144 J | 0.00000103 J |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.00000935 | 0.000000427 JN | 0.000000416 JN | 0.00000414 | 0.00000164 J | 0.00000146 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.0000106 | 0.000000624 J | 0.000000517 J | 0.00000363 | 0.00000199 J | 0.000000702 JN |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.0000105 | 0.000000607 J | 0.000000502 J | 0.00000463 | 0.00000149 J | 0.00000284 |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.000019 | 0.00000152 J | 0.00000119 J | 0.00000798 | 0.00000444 | 0.0000026 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000842 JN | < 0.000000109 U | < 0.000000124 U | 0.000000455 JN | 0.0000000765 JN | 0.000000129 J |

**Table 5-3**
**Sediment Sample-by-Sample Screen:**
**2017 Waterside Investigation Area and Background Samples**

| | | | | Site Samples | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Area** | Site - Cove | Site - Channel | Site - Channel | Site - Channel | Site - Channel | Site - Channel |
| | | | **Location** | SED7F | SED6A | SED6B | SED6C | SED7A | SED7B |
| | | | **Sample** | SED7F00EN | SED6A00EN | SED6B00EN | SED6C00EN | SED7A00EN | SED7B00EN |
| | | | **Sample Date** | 6/8/2017 | 6/8/2017 | 6/8/2017 | 6/7/2017 | 6/9/2017 | 6/7/2017 |
| | | | **Depth Interval** | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.0000151 | 0.00000148 J | 0.0000011 J | 0.00000607 | 0.00000452 | 0.00000167 J |
| 1,2,3,7,8-PeCDF | NV | NV | mg/kg | 0.00000499 J | 0.000000316 J | 0.000000174 JN | 0.00000209 J | 0.000000568 J | 0.000000627 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000972 | 0.000000489 J | 0.000000325 JN | 0.00000318 | 0.00000108 J | 0.000000545 J |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.0000148 | 0.000000916 J | 0.000000808 J | 0.00000601 | 0.00000241 | 0.00000415 |
| 2,3,4,7,8-Pentachlorodibenzofuran | NV | NV | mg/kg | 0.0000148 J | 0.0000012 J | 0.000001 JN | 0.00000832 J | 0.00000285 JN | 0.0000082 J |
| 2,3,7,8-Tetrachlorodibenzofuran | NV | NV | mg/kg | 0.00000356 | 0.000000539 J | 0.000000412 | 0.00000223 | 0.0000011 | 0.00000143 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.0000016 | < 0.000000104 U | 0.000000102 J | 0.000000743 | 0.000000286 JN | 0.000000597 |
| Octachlorochlorodibenzofuran | NV | NV | mg/kg | 0.0000625 | 0.0000168 | 0.0000113 | 0.0000552 | 0.0000581 | 0.0000359 |
| Octachlorochlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00139 | 0.00112 | 0.000911 | 0.00379 | 0.00444 | 0.00255 |

Notes:
All concentrations reported in milligrams per kilogram (mg/kg).
Yellow highlighted cells indicate concentrations that are greater than the Low Effect ESV.
Orange highlighted cells indicate concentrations that are greater than the Probable Effect ESV.
ESVs identified on Table 3-1.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
J - Estimated value.
NOAA - National Oceanic and Atmospheric Administration.
NV - No ESV or Effects-based ESV Available.
OMOE - Ontario Ministry of Environment and Energy.
PAH - Polycyclic Aromatic Hydrocarbon.
PCB - Polychlorinated biphenyls.
SQuiRTs - Screening Quick Reference Tables.
U - Not detected.
USEPA - United States Environmental Protection Agency.
(a) Sediment COPCs identified in Table 3-3 are presented. Duplicate samples were resolved by use of the maximum detected concentrations.
(b) Low Effect ESVs selected based on a hierarchy of freshwater values from NOAA SQuiRT tables (Buchman 2008), USEPA Region 3 freshwater sediment screening values (USEPA 2006), USEPA Region 5 Ecological Screening Levels (USEPA 2003), OMOE (Persaud 1993), and USEPA Region 4 recommended ecological screening values (USEPA, 2018).
(c) Probable Effect ESVs are based on the Probable Effects Concentrations (MacDonald et al. 2000), or either the Upper Effects Thresholds (UET) or Severe Effect Level (SEL) if the UET was not available (Buchman, 2008), and and USEPA Region 4 recommended refined Screening Value (USEPA, 2018).

**Table 5-3**
**Sediment Sample-by-Sample Screen:**
**2017 Waterside Investigation Area and Background Samples**

| | | | | Site Samples | | | Background Samples | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Area** | Site - Channel | Site - Channel | Site - Channel | Background | Background | Background |
| | | | **Location** | SED8A | SED8B | SED8C | SEDBACK16 | SEDBACK17 | SEDBACK18 |
| | | | **Sample** | SED8A00EN | SED8B00EN | SED8C00EN | SEDBACK1600N | SEDBACK1700N | SEDBACK1800N |
| | | | **Sample Date** | 6/9/2017 | 6/9/2017 | 6/7/2017 | 6/12/2017 | 6/12/2017 | 6/12/2017 |
| | | | **Depth Interval** | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | | | | | |
| **Metals** | | | | | | | | | |
| Antimony | 2 | 3 | mg/kg | 1.1 | 1 | 0.89 | 1.1 J | 1.1 J | 0.50 J |
| Barium | 0.7 | 60 | mg/kg | **120** | **100** | **99** | **90 J** | **92** | **54** |
| Beryllium | NV | NV | mg/kg | 1.7 | 1.5 | 1.4 | 0.94 J | 1.2 | 0.73 |
| Cadmium | 0.58 | 5.0 | mg/kg | **0.86** | **0.69** | **0.82** | 0.47 J | 0.48 | 0.27 |
| Iron | 20000 | 40000 | mg/kg | **32000** | **29000** | **27000** | 19000 J | **22000** | 16000 |
| Lead | 31 | 128 | mg/kg | **62** | **55** | **55** | **45 J** | **39** | 22 |
| Manganese | 460 | 1100 | mg/kg | 420 | 390 | 350 | **520 J** | 380 | 210 |
| Mercury | 0.174 | 1.06 | mg/kg | **0.21** | 0.11 | **0.21** | 0.13 J | 0.13 J+ | 0.054 J+ |
| Nickel | 16 | 48.6 | mg/kg | **38** | **36** | **35** | **35 J** | **38** | **27** |
| Silver | 0.5 | 4.5 | mg/kg | 0.33 | 0.25 | 0.27 | 0.11 J | 0.18 | 0.075 J |
| Thallium | NV | NV | mg/kg | 0.26 | 0.23 | 0.22 | 0.20 J | 0.24 | 0.16 |
| Vanadium | NV | NV | mg/kg | 45 | 41 | 39 | 31 J | 34 | 22 |
| Zinc | 98 | 459 | mg/kg | **260** | **240** | **240** | **190 J** | **200 J** | **120 J** |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 0.00354 | 0.028 | mg/kg | 0.0025 J | 0.0021 J | **0.0051 J** | 0.0015 J | 0.0023 J | 0.0011 J |
| 4,4'-DDE | 0.00316 | 0.0313 | mg/kg | **0.0061** | **0.004** | **0.013** | **0.0032 J** | **0.0042** | 0.0019 |
| 4,4'-DDT | 0.00119 | 0.0629 | mg/kg | < 0.0011 U | **0.0018 J** | < 0.0011 U | **0.0039 J** | **0.0013 J** | < 0.00085 U |
| Aldrin | 0.002 | 0.04 | mg/kg | < 0.0011 U | < 0.0011 U | < 0.0011 U | < 0.0015 UJ | < 0.0012 U | < 0.00085 U |
| cis-Chlordane | 3.00E-05 | 0.0176 | mg/kg | **0.0067 J** | **0.0048 J** | **0.016** | **0.0070 J** | **0.0095 J** | **0.0034 J** |
| Dieldrin | 0.0019 | 0.0618 | mg/kg | **0.0020 J** | 0.0015 J | **0.004** | **0.0031 J** | **0.0034 J** | 0.0013 J |
| Endosulfan Sulfate | 0.0054 | NV | mg/kg | < 0.0011 U | < 0.0011 U | < 0.0011 U | R | R | < 0.00085 U |
| Endrin | 0.00222 | 0.207 | mg/kg | < 0.0011 U | 0.00049 J | < 0.0011 U | < 0.0015 UJ | < 0.0012 U | < 0.00085 U |
| Endrin ketone | 0.00222 | 0.207 | mg/kg | < 0.0011 U | < 0.0011 U | < 0.0011 U | < 0.0015 UJ | < 0.0012 U | < 0.00085 U |
| Heptachlor Epoxide | 0.0006 | 0.016 | mg/kg | **0.00080 J** | 0.00039 J | **0.00085 J** | **0.0013 J** | **0.00094 J** | 0.00041 J |
| Methoxychlor | 0.0187 | 0.059 | mg/kg | < 0.0011 U | < 0.0011 U | < 0.0011 U | < 0.0015 UJ | < 0.0012 U | < 0.00085 U |
| trans-Chlordane | 3.00E-05 | 0.0176 | mg/kg | **0.0089** | **0.0063** | **0.013** | **0.0090 J** | **0.013 J-** | **0.0046** |
| **Polychlorinated Biphenyls (PCBs)** | | | | | | | | | |
| PCB, Total Aroclors | 0.026 | 0.676 | mg/kg | **0.059** | **0.033** | **0.26** | **0.14** | **0.045** | 0.022 |
| PCB, Total Congeners | 0.026 | 0.676 | mg/kg | | | | **0.041** | **0.38** | **0.037** |
| **Semi-Volatile Organic Compounds (SVOCs via Method ID0016)** | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | NV | NV | mg/kg | 0.014 J | 0.0089 J | 0.03 | 0.024 J | 0.01 J | 0.0042 J |
| 2,6-Dimethylnaphthalene | NV | NV | mg/kg | 0.031 | 0.016 J | 0.045 | 0.031 J | 0.014 J | 0.0075 J |
| Total High-molecular-weight PAHs | 0.193 | 6.5 | mg/kg | **10** | **8.3** | **11** | **18** | **12** | **4.6** |
| Total Low-molecular-weight PAHs | 0.07642 | 5.3 | mg/kg | **0.71** | **0.74** | **0.77** | **2.2** | **0.94** | **0.37** |
| Total PAHs (sum 16) | 0.2641 | 22.8 | mg/kg | **11** | **9** | **12** | **20** | **13** | **4.9** |
| **DioxinFurans** | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | NV | NV | mg/kg | 0.00000698 | 0.0000135 | 0.0000214 | 0.0000119 | 0.0000234 | 0.0000104 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.0000617 | 0.0000856 | 0.000125 | 0.0000617 | 0.000148 J | 0.0000779 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | NV | NV | mg/kg | 0.000000543 J | 0.000000859 J | 0.00000177 J | 0.000000773 J | < 0.000000516 U | < 0.000000264 U |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000705 J | 0.00000113 J | 0.00000275 | 0.000000994 J | 0.00000162 J | 0.000000745 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.000000791 J | 0.00000124 J | 0.00000257 | 0.000000914 JN | 0.00000232 J | 0.00000105 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000587 J | 0.0000011 J | 0.00000282 | 0.000000689 JN | 0.00000165 JN | 0.000000746 J |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000187 J | 0.00000276 | 0.0000054 | 0.00000227 J | 0.00000481 | 0.00000233 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | NV | NV | mg/kg | < 0.000000186 U | 0.0000000583 JN | < 0.000000242 U | < 0.000000159 U | < 0.000000487 U | < 0.00000019 U |

**Table 5-3**
**Sediment Sample-by-Sample Screen:**
**2017 Waterside Investigation Area and Background Samples**

| | | | | Site Samples | | | Background Samples | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Area** | Site - Channel | Site - Channel | Site - Channel | Background | Background | Background |
| | | | **Location** | SED8A | SED8B | SED8C | SEDBACK16 | SEDBACK17 | SEDBACK18 |
| | | | **Sample** | SED8A00EN | SED8B00EN | SED8C00EN | SEDBACK1600N | SEDBACK1700N | SEDBACK1800N |
| | | | **Sample Date** | 6/9/2017 | 6/9/2017 | 6/7/2017 | 6/12/2017 | 6/12/2017 | 6/12/2017 |
| | | | **Depth Interval** | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000165 JN | 0.00000268 | 0.00000483 | 0.00000209 J | 0.00000494 | 0.00000205 |
| 1,2,3,7,8-PeCDF | NV | NV | mg/kg | 0.000000215 J | 0.000000386 J | 0.00000129 J | 0.00000025 J | < 0.000000331 U | < 0.000000188 U |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.000000562 J | 0.000000713 J | 0.00000171 JN | 0.0000008 J | 0.00000117 JN | 0.000000609 J |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000907 JN | 0.00000157 J | 0.00000406 | 0.00000117 J | 0.00000225 J | 0.000000946 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | NV | NV | mg/kg | 0.00000123 J | 0.00000204 J | 0.00000556 J | 0.000000991 J | 0.00000182 JN | 0.000000991 J |
| 2,3,7,8-Tetrachlorodibenzofuran | NV | NV | mg/kg | 0.000000459 J | 0.000000826 JN | 0.00000173 | 0.000000457 J | 0.000000964 | 0.000000437 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | NV | NV | mg/kg | < 0.000000131 U | 0.000000207 J | 0.000000497 | < 0.000000172 U | < 0.000000338 U | < 0.000000164 U |
| Octachlorochlorodibenzofuran | NV | NV | mg/kg | 0.0000177 | 0.0000311 | 0.0000472 | 0.0000265 | 0.0000564 J | 0.0000298 |
| Octachlorochlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00172 | 0.00281 | 0.00366 | 0.00117 | 0.00558 | 0.00249 |

Notes:
All concentrations reported in milligrams per kilogram (mg/kg).
Yellow highlighted cells indicate concentrations that are greater than the Low Effect ESV.
Orange highlighted cells indicate concentrations that are greater than the Probable Effect ESV.
ESVs identified on Table 3-1.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
J - Estimated value.
NOAA - National Oceanic and Atmospheric Administration.
NV - No ESV or Effects-based ESV Available.
OMOE - Ontario Ministry of Environment and Energy.
PAH - Polycyclic Aromatic Hydrocarbon.
PCB - Polychlorinated biphenyls.
SQuiRTs - Screening Quick Reference Tables.
U - Not detected.
USEPA - United States Environmental Protection Agency.
(a) Sediment COPCs identified in Table 3-3 are presented. Duplicate samples were resolved by use of the maximum detected concentrations.
(b) Low Effect ESVs selected based on a hierarchy of freshwater values from NOAA SQuiRT tables (Buchman 2008), USEPA Region 3 freshwater sediment screening values (USEPA 2006), USEPA Region 5 Ecological Screening Levels (USEPA 2003), OMOE (Persaud 1993), and USEPA Region 4 recommended ecological screening values (USEPA, 2018).
(c) Probable Effect ESVs are based on the Probable Effects Concentrations (MacDonald et al. 2000), or either the Upper Effects Thresholds (UET) or Severe Effect Level (SEL) if the UET was not available (Buchman, 2008), and and USEPA Region 4 recommended refined Screening Value (USEPA, 2018).

**Table 5-3**
**Sediment Sample-by-Sample Screen:**
**2017 Waterside Investigation Area and Background Samples**

| | | | | **Background Samples** | |
|---|---|---|---|---|---|
| | | | **Area** | Background | Background |
| | | | **Location** | SEDBACK19 | SEDBACK20 |
| | | | **Sample** | SEDBACK1900N | SEDBACK2000N |
| | | | **Sample Date** | 6/13/2017 | 6/13/2017 |
| | | | **Depth Interval** | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | |
| **Metals** | | | | | |
| Antimony | 2 | 3 | mg/kg | 0.55 | 0.55 |
| Barium | 0.7 | 60 | mg/kg | **49** | **61** |
| Beryllium | NV | NV | mg/kg | 0.87 | 0.88 |
| Cadmium | 0.58 | 5.0 | mg/kg | 0.53 | 0.4 |
| Iron | 20000 | 40000 | mg/kg | **22000** | 18000 |
| Lead | 31 | 128 | mg/kg | 27 | 29 |
| Manganese | 460 | 1100 | mg/kg | 230 | 250 |
| Mercury | 0.174 | 1.06 | mg/kg | 0.067 | 0.092 |
| Nickel | 16 | 48.6 | mg/kg | **24** | **23** |
| Silver | 0.5 | 4.5 | mg/kg | 0.088 J | 0.11 |
| Thallium | NV | NV | mg/kg | 0.11 | 0.13 |
| Vanadium | NV | NV | mg/kg | 28 | 26 |
| Zinc | 98 | 459 | mg/kg | **160** | **140** |
| **Pesticides** | | | | | |
| 4,4'-DDD | 0.00354 | 0.028 | mg/kg | 0.00050 J | 0.0012 J |
| 4,4'-DDE | 0.00316 | 0.0313 | mg/kg | 0.00087 J | 0.0025 |
| 4,4'-DDT | 0.00119 | 0.0629 | mg/kg | < 0.00079 U | **0.0014 J** |
| Aldrin | 0.002 | 0.04 | mg/kg | < 0.00079 U | < 0.00087 U |
| cis-Chlordane | 3.00E-05 | 0.0176 | mg/kg | **0.0033 J** | **0.0043 J** |
| Dieldrin | 0.0019 | 0.0618 | mg/kg | 0.0012 J+ | 0.0016 J |
| Endosulfan Sulfate | 0.0054 | NV | mg/kg | < 0.00079 U | < 0.00087 U |
| Endrin | 0.00222 | 0.207 | mg/kg | 0.00054 J | 0.00029 J |
| Endrin ketone | 0.00222 | 0.207 | mg/kg | < 0.00079 U | < 0.00087 U |
| Heptachlor Epoxide | 0.0006 | 0.016 | mg/kg | 0.00043 J | 0.00051 J |
| Methoxychlor | 0.0187 | 0.059 | mg/kg | < 0.00079 U | < 0.00087 U |
| trans-Chlordane | 3.00E-05 | 0.0176 | mg/kg | **0.0038** | **0.0057 J** |
| **Polychlorinated Biphenyls (PCBs)** | | | | | |
| PCB, Total Aroclors | 0.026 | 0.676 | mg/kg | **0.077** | **0.052** |
| PCB, Total Congeners | 0.026 | 0.676 | mg/kg | **0.14** | **0.06** |
| **Semi-Volatile Organic Compounds (SVOCs via Method ID0016)** | | | | | |
| 2,3,5-Trimethylnaphthalene | NV | NV | mg/kg | 0.0059 J | 0.0034 J |
| 2,6-Dimethylnaphthalene | NV | NV | mg/kg | 0.0078 J | 0.0056 J |
| Total High-molecular-weight PAHs | 0.193 | 6.5 | mg/kg | **3.8** | **3.7** |
| Total Low-molecular-weight PAHs | 0.07642 | 5.3 | mg/kg | **0.41** | **0.29** |
| Total PAHs (sum 16) | 0.2641 | 22.8 | mg/kg | **4.2** | **4** |
| **DioxinFurans** | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | NV | NV | mg/kg | 0.00000575 | 0.00001 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.0000438 | 0.000068 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | NV | NV | mg/kg | < 0.000000419 U | < 0.000000359 U |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000975 J | 0.000000738 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.000000624 J | 0.000000907 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000506 | 0.000000631 J |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000138 J | 0.00000189 J |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | NV | NV | mg/kg | < 0.000000152 U | < 0.000000201 U |

## Table 5-3
## Sediment Sample-by-Sample Screen:
## 2017 Waterside Investigation Area and Background Samples

| | | | | Background Samples | |
|---|---|---|---|---|---|
| | | | **Area** | Background | Background |
| | | | **Location** | SEDBACK19 | SEDBACK20 |
| | | | **Sample** | SEDBACK1900N | SEDBACK2000N |
| | | | **Sample Date** | 6/13/2017 | 6/13/2017 |
| | | | **Depth Interval** | 0 - 0.33 ft | 0 - 0.33 ft |
| **COPC (a)** | **Low Effect ESV (b)** | **Probable Effect ESV (c)** | Units | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000126 J | 0.00000196 |
| 1,2,3,7,8-PeCDF | NV | NV | mg/kg | < 0.000000162 U | < 0.000000257 U |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00000046 J | < 0.000000261 U |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | NV | NV | mg/kg | 0.000000733 J | 0.0000011 JN |
| 2,3,4,7,8-Pentachlorodibenzofuran | NV | NV | mg/kg | 0.00000133 J | 0.00000121 J |
| 2,3,7,8-Tetrachlorodibenzofuran | NV | NV | mg/kg | 0.000000411 | 0.000000543 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | NV | NV | mg/kg | < 0.000000161 U | < 0.000000226 U |
| Octachlorochlorodibenzofuran | NV | NV | mg/kg | 0.0000145 | 0.0000264 |
| Octachlorochlorodibenzo-p-dioxin | NV | NV | mg/kg | 0.00144 | 0.00255 |

Notes:
All concentrations reported in milligrams per kilogram (mg/kg).
Yellow highlighted cells indicate concentrations that are greater than the Low Effect ESV.
Orange highlighted cells indicate concentrations that are greater than the Probable Effect ESV.
ESVs identified on Table 3-1.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
J - Estimated value.
NOAA - National Oceanic and Atmospheric Administration.
NV - No ESV or Effects-based ESV Available.
OMOE - Ontario Ministry of Environment and Energy.
PAH - Polycyclic Aromatic Hydrocarbon.
PCB - Polychlorinated biphenyls.
SQuiRTs - Screening Quick Reference Tables.
U - Not detected.
USEPA - United States Environmental Protection Agency.
(a) Sediment COPCs identified in Table 3-3 are presented. Duplicate samples were resolved by use of the maximum detected concentrations.
(b) Low Effect ESVs selected based on a hierarchy of freshwater values from NOAA SQuiRT tables (Buchman 2008), USEPA Region 3 freshwater sediment screening values (USEPA 2006), USEPA Region 5 Ecological Screening Levels (USEPA 2003), OMOE (Persaud 1993), and USEPA Region 4 recommended ecological screening values (USEPA, 2018).
(c) Probable Effect ESVs are based on the Probable Effects Concentrations (MacDonald et al. 2000), or either the Upper Effects Thresholds (UET) or Severe Effect Level (SEL) if the UET was not available (Buchman, 2008), and and USEPA Region 4 recommended refined Screening Value (USEPA, 2018).

**Table 5-4**
**Correlation Analysis of Chemical and Physical Parameters with Toxicity Test Results for Amphipod and Midge**

| Parameter | Amphipod Survival (%) | Amphipod Growth (mg) | Midge Survival (%) | Midge Growth (mg) | IBI Values |
|---|---|---|---|---|---|
| IBI | -- | -- | -- | -- | -- |
| 4,4'-DDE PEC-Q | -- | -- | -- | 0.001 | -- |
| Total PCB Aroclor PEC-Q | -- | -- | -- | 0.007 | -- |
| ΣEqPTU Porewater | -- | -- | -- | 0.007 | -- |
| ∑ESBTU Sediment | -- | -- | -- | 0.008 | -- |
| Percent gravel | -- | -- | -- | -- | -- |
| Percent sand | -- | -- | -- | -- | -- |
| Percent silt | -- | -- | -- | 0.033 | -- |
| Percent clay | -- | -- | -- | -- | -- |
| Percent fines (g) | -- | -- | -- | 0.029 | -- |
| Total Organic Carbon | -- | -- | -- | -- | -- |

Only p-values less than 0.05 are presented and indicate a significant correlation.

**Table 6-1**
**Comparison of COPC Concentrations Detected in 0 - 15.2 cm (0 – 0.5 ft) and 0 - 10 cm (0 – 0.33 ft) Sediment Samples in the Waterside Investigation Area**

| COPC | Depth Interval | FOD [a] | Detected Concentrations (mg/kg) Minimum | Mean | Standard Deviation | Maximum | Relative Percent Difference [b] Mean | Maximum |
|---|---|---|---|---|---|---|---|---|
| **Dioxins/Furans** | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 4.79E-06 | 3.61E-05 | 2.69E-05 | 9.36E-05 | | |
| | 0 - 0.5 ft | 26:26 | 2.37E-07 | 1.01E-04 | 2.32E-04 | 1.08E-03 | 95% | 168% |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 0 - 0.33 ft | 15:15 | 3.82E-05 | 1.53E-04 | 9.68E-05 | 3.82E-04 | | |
| | 0 - 0.5 ft | 26:26 | 8.42E-06 | 3.92E-04 | 8.81E-04 | 4.10E-03 | 88% | 166% |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 3.70E-07 | 3.69E-06 | 3.52E-06 | 1.20E-05 | | |
| | 0 - 0.5 ft | 22:22 | 8.00E-08 | 1.49E-05 | 3.59E-05 | 1.51E-04 | 121% | 171% |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 4.16E-07 | 6.26E-06 | 6.07E-06 | 1.86E-05 | | |
| | 0 - 0.5 ft | 24:24 | 9.02E-08 | 4.63E-05 | 1.08E-04 | 4.70E-04 | 152% | 185% |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 0 - 0.33 ft | 15:15 | 5.17E-07 | 6.41E-06 | 6.31E-06 | 1.96E-05 | | |
| | 0 - 0.5 ft | 24:24 | 1.58E-07 | 2.59E-05 | 6.64E-05 | 2.89E-04 | 121% | 175% |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 5.02E-07 | 7.04E-06 | 6.76E-06 | 2.08E-05 | | |
| | 0 - 0.5 ft | 21:21 | 1.05E-07 | 2.93E-05 | 6.43E-05 | 2.72E-04 | 123% | 172% |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 0 - 0.33 ft | 15:15 | 1.19E-06 | 1.27E-05 | 1.21E-05 | 4.00E-05 | | |
| | 0 - 0.5 ft | 26:26 | 2.65E-07 | 4.50E-05 | 1.21E-04 | 5.48E-04 | 112% | 173% |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 0 - 0.33 ft | 15:11 | 5.83E-08 | 8.71E-07 | 7.93E-07 | 2.53E-06 | | |
| | 0 - 0.5 ft | 16:16 | 6.05E-08 | 3.13E-06 | 6.62E-06 | 2.43E-05 | 113% | 162% |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 0 - 0.33 ft | 15:15 | 1.10E-06 | 1.05E-05 | 9.81E-06 | 3.24E-05 | | |
| | 0 - 0.5 ft | 25:25 | 2.09E-07 | 6.27E-05 | 1.61E-04 | 7.05E-04 | 143% | 182% |
| 1,2,3,7,8-Pentachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 1.74E-07 | 3.49E-06 | 3.61E-06 | 1.05E-05 | | |
| | 0 - 0.5 ft | 23:23 | 1.13E-07 | 1.23E-05 | 2.89E-05 | 1.24E-04 | 112% | 169% |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 0 - 0.33 ft | 15:15 | 3.25E-07 | 5.93E-06 | 6.21E-06 | 1.84E-05 | | |
| | 0 - 0.5 ft | 24:24 | 4.26E-08 | 2.35E-05 | 6.16E-05 | 2.77E-04 | 119% | 175% |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 8.08E-07 | 9.81E-06 | 9.33E-06 | 2.95E-05 | | |
| | 0 - 0.5 ft | 24:24 | 7.37E-08 | 2.59E-05 | 6.47E-05 | 2.85E-04 | 90% | 162% |
| 2,3,4,7,8-Pentachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 1.00E-06 | 1.04E-05 | 8.76E-06 | 2.63E-05 | | |
| | 0 - 0.5 ft | 23:23 | 3.45E-07 | 2.22E-05 | 5.16E-05 | 2.17E-04 | 73% | 157% |
| 2,3,7,8-Tetrachlorodibenzofuran | 0 - 0.33 ft | 15:15 | 4.12E-07 | 2.92E-06 | 2.43E-06 | 7.58E-06 | | |
| | 0 - 0.5 ft | 25:25 | 1.27E-07 | 6.88E-06 | 1.32E-05 | 5.67E-05 | 81% | 153% |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 0 - 0.33 ft | 15:13 | 1.02E-07 | 1.38E-06 | 1.19E-06 | 3.94E-06 | | |
| | 0 - 0.5 ft | 21:26 | 5.93E-08 | 4.33E-06 | 9.31E-06 | 3.82E-05 | 104% | 163% |
| Octachlorochlorodibenzofuran | 0 - 0.33 ft | 15:15 | 1.13E-05 | 5.59E-05 | 3.42E-05 | 1.29E-04 | | |
| | 0 - 0.5 ft | 24:24 | 5.14E-07 | 1.10E-04 | 2.18E-04 | 1.00E-03 | 65% | 154% |
| Octachlorochlorodibenzo-p-dioxin | 0 - 0.33 ft | 15:15 | 9.11E-04 | 2.56E-03 | 1.31E-03 | 4.57E-03 | | |
| | 0 - 0.5 ft | 26:26 | 3.38E-04 | 4.17E-03 | 3.78E-03 | 1.47E-02 | 48% | 105% |
| **Inorganics** | | | | | | | | |
| Antimony | 0 - 0.33 ft | 18:18 | 4.20E-01 | 3.55E+00 | 9.86E+00 | 4.30E+01 | | |
| | 0 - 0.5 ft | 65:65 | 5.00E-02 | 5.69E-01 | 4.04E-01 | 2.80E+00 | 145% | 176% |
| Arsenic | 0 - 0.33 ft | 18:18 | 2.80E+00 | 6.22E+00 | 2.95E+00 | 1.70E+01 | | |
| | 0 - 0.5 ft | 66:66 | 7.90E-01 | 4.06E+00 | 2.82E+00 | 1.70E+01 | 42% | 0% |
| Barium | 0 - 0.33 ft | 18:18 | 5.20E+01 | 8.99E+01 | 2.46E+01 | 1.20E+02 | | |
| | 0 - 0.5 ft | 66:66 | 1.70E+01 | 8.29E+01 | 3.00E+01 | 1.80E+02 | 8% | 40% |
| Beryllium | 0 - 0.33 ft | 18:18 | 5.10E-01 | 1.21E+00 | 4.04E-01 | 1.80E+00 | | |
| | 0 - 0.5 ft | 66:66 | 1.50E-01 | 1.03E+00 | 3.98E-01 | 2.20E+00 | 16% | 20% |
| Nickel | 0 - 0.33 ft | 18:18 | 1.90E+01 | 4.47E+01 | 1.83E+01 | 9.70E+01 | | |
| | 0 - 0.5 ft | 66:66 | 7.70E+00 | 3.73E+01 | 2.97E+01 | 1.60E+02 | 18% | 49% |
| Thallium | 0 - 0.33 ft | 18:18 | 1.20E-01 | 2.07E-01 | 4.67E-02 | 2.70E-01 | | |
| | 0 - 0.5 ft | 66:66 | 3.70E-02 | 2.00E-01 | 9.32E-02 | 6.30E-01 | 3% | 80% |
| Vanadium | 0 - 0.33 ft | 18:18 | 2.10E+01 | 6.54E+01 | 3.90E+01 | 1.60E+02 | | |
| | 0 - 0.5 ft | 66:66 | 8.50E+00 | 5.87E+01 | 7.53E+01 | 4.40E+02 | 11% | 93% |
| **Pesticides and PCBs** | | | | | | | | |
| 4,4'-DDT | 0 - 0.33 ft | 1:15 | 1.80E-03 | 1.80E-03 | NA | 1.80E-03 | | |
| | 0 - 0.5 ft | 32:32 | 3.70E-04 | 5.28E-02 | 2.64E-01 | 1.50E+00 | 187% | 200% |
| 4,4'-DDD | 0 - 0.33 ft | 15:15 | 1.80E-03 | 3.87E-03 | 1.65E-03 | 8.10E-03 | | |
| | 0 - 0.5 ft | 34:34 | 7.60E-04 | 6.78E-03 | 1.12E-02 | 6.80E-02 | 55% | 157% |
| 4,4'-DDE | 0 - 0.33 ft | 15:15 | 3.90E-03 | 9.65E-03 | 9.40E-03 | 4.00E-02 | | |
| | 0 - 0.5 ft | 33:34 | 1.40E-03 | 9.59E-03 | 1.07E-02 | 5.60E-02 | 1% | 33% |
| Total PCB Aroclors | 0 - 0.33 ft | 18:18 | 3.30E-02 | 2.86E-01 | 2.51E-01 | 7.90E-01 | | |
| | 0 - 0.5 ft | 65:65 | 3.10E-03 | 3.21E-01 | 3.97E-01 | 1.90E+00 | 12% | 83% |
| Total PCB Congeners | 0 - 0.33 ft | 8:8 | 1.80E-01 | 6.19E-01 | 4.78E-01 | 1.40E+00 | | |
| | 0 - 0.5 ft | 24:24 | 3.80E-02 | 1.00E+00 | 2.44E+00 | 1.18E+01 | 47% | 158% |

**Table 6-1**

**Comparison of COPC Concentrations Detected in 0 - 15.2 cm (0 – 0.5 ft) and 0 - 10 cm (0 – 0.33 ft) Sediment Samples in the Waterside Investigation Area**

| COPC | Depth Interval | FOD [a] | Detected Concentrations (mg/kg) | | | | Relative Percent Difference [b] | |
|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Mean | Standard Deviation | Maximum | Mean | Maximum |
| **Semi-volatile Organic Compounds** | | | | | | | | |
| Total High-molecular-weight PAHs | 0 - 0.33 ft | 3:3 | 5.10E+00 | 5.80E+00 | 8.19E-01 | 6.70E+00 | | |
| | 0 - 0.5 ft | 65:65 | 2.50E-01 | 6.81E+00 | 3.63E+00 | 2.40E+01 | 16% | 113% |

Notes:

COPC - Chemical of Potential Concern.

FOD - Frequency of Detection.

ft - Feet.

NA - Not Available.

PAH - Polycyclic Aromatic Hydrocarbon.

PCB - Polychlorinated biphenyls.

SD - Standard Deviation.

[a] FOD is the number of detected concentrations: the total number of samples.

[b] Relative percent difference of upper (0-0.33 ft) and lower (0-0.5 ft) sediment depths calculated as the absolute difference between upper and lower concentrations divided by the average of the upper and lower concentrations (multiplied by 100).

**Table 6-2**
**Comparison of PCB Congener Results to PCB Aroclor Results for Surface Sediment**

| Source | Sample Location | Sample Identification | Sample Date | Depth (cm) | Total Congeners (mg/kg) | Total Aroclors (mg/kg) | Ratio of Total Congener to Total Aroclor |
|---|---|---|---|---|---|---|---|
| Pepco | SED2A | SED2A00N | 11/6/2013 | 0 - 15.2 | 0.294 | 0.23 | 1.3 |
| Pepco | SED7.5E | SED7.5E00N | 11/25/2013 | 0 - 15.2 | 11.8 | 1.9 | 6.2 |
| Pepco | SED9.5B | SED9.5B00N | 11/11/2013 | 0 - 15.2 | 0.17 | 0.38 | 0.4 |
| Pepco | SED1.5B | SED1.5B00FN | 11/6/2013 | 0 - 10 | 0.41 | 0.23 | 1.8 |
| Pepco | SED1.5C | SED1.5C00AN | 6/21/2017 | 0 - 10 | 0.18 | 0.087 | 2.1 |
| Pepco | SED1.5C | SED1.5C00CN | 6/21/2017 | 0 - 10 | 0.39 | 0.18 | 2.2 |
| Pepco | SED5B | SED5B00AN | 6/20/2017 | 0 - 10 | 0.24 | 0.18 | 1.3 |
| Pepco | SED5C | SED5C00FN | 6/20/2017 | 0 - 10 | 0.73 | 0.49 | 1.5 |
| Pepco | SED6.5D | SED6.5D00FN | 6/9/2017 | 0 - 10 | 5.5 | 2.8 | 2.0 |
| Pepco | SED6.5E | SED6.5E00EN | 6/8/2017 | 0 - 10 | 0.76 | 0.25 | 3.0 |
| Pepco | SED6A | SED6A00EN | 6/8/2017 | 0 - 10 | 0.18 | 0.069 | 2.6 |
| Pepco | SED6B | SED6B00EN | 6/8/2017 | 0 - 10 | 0.21 | 0.13 | 1.6 |
| Pepco | SED7.5E | SED7.5E00EN | 6/8/2017 | 0 - 10 | 1.4 | 0.78 | 1.8 |
| Pepco | SED7D | SED7D00FN | 6/9/2017 | 0 - 10 | 6.1 | 3.9 | 1.6 |
| Pepco | SED7E | SED7E00EN | 6/8/2017 | 0 - 10 | 0.98 | 0.63 | 1.6 |
| Pepco | SED7F | SED7F00EN | 6/8/2017 | 0 - 10 | 1 | 0.3 | 3.3 |
| DOEE | R5-03 | RI-R5-03-SS | 7/25/2014 | 0 - 15.2 | 0.16 | 0.097 | 1.6 |
| DOEE | R5-04 | RI-R5-04-SS | 7/28/2014 | 0 - 15.2 | 0.19 | 0.053 | 3.6 |
| DOEE | R5-05 | RI-R5-05-SS | 7/30/2014 | 0 - 15.2 | 0.24 | 0.11 | 2.2 |
| DOEE | R5-06 | RI-R5-06-SS | 4/30/2015 | 0 - 15.2 | 0.1 | 0.091 | 1.1 |
| DOEE | R6-01 | RI-R6-01-SS | 8/5/2014 | 0 - 15.2 | 0.1 | 0.081 | 1.2 |
| DOEE | R6-02 | RI-R6-02-SS | 7/28/2014 | 0 - 15.2 | 0.28 | 0.058 | 4.8 |
| DOEE | R6-03 | RI-R6-03-SS | 7/28/2014 | 0 - 15.2 | 1 | 0.46 | 2.2 |
| DOEE | R6-04 | RI-R6-04-SS | 7/28/2014 | 0 - 15.2 | 3.711 | 0.98 | 3.8 |
| DOEE | R6-05 | RI-R6-05-SS | 8/4/2014 | 0 - 15.2 | 1.3 | 1.4 | 0.9 |
| DOEE | R6-06 | RI-R6-06-SS | 8/4/2014 | 0 - 15.2 | 0.1279 | 0.0845 | 1.5 |
| DOEE | R6-07 | RI-R6-07-SS | 7/30/2014 | 0 - 15.2 | 0.038 | 0.028 | 1.4 |
| DOEE | R6-18 | RI-R6-18-SS | 4/30/2015 | 0 - 15.2 | 0.19 | 0.088 | 2.2 |
| DOEE | R6-21 | RI-R6-21-SS | 4/29/2015 | 0 - 15.2 | 0.96 | 0.42 | 2.3 |
| DOEE | R6-22 | RI-R6-22-SS | 4/30/2015 | 0 - 15.2 | 0.19 | 0.089 | 2.1 |
| DOEE | R6-23 | RI-R6-23-SS | 4/30/2015 | 0 - 15.2 | 0.15 | 0.066 | 2.3 |
| | | | | **Summary Statistics** | | | |
| | | | | **Minimum** | 0.038 | 0.028 | 0.45 |
| | | | | **Maximum** | 11.8 | 3.9 | 6.2 |
| | | | | **Mean** | 1.26 | 0.54 | 2.2 |
| | | | | **Median** | 0.28 | 0.18 | 2.0 |

Note:
cm - Centimeter
mg/kg - Milligram per kilogram.
PCB - Polychlorinated Biphenyl.

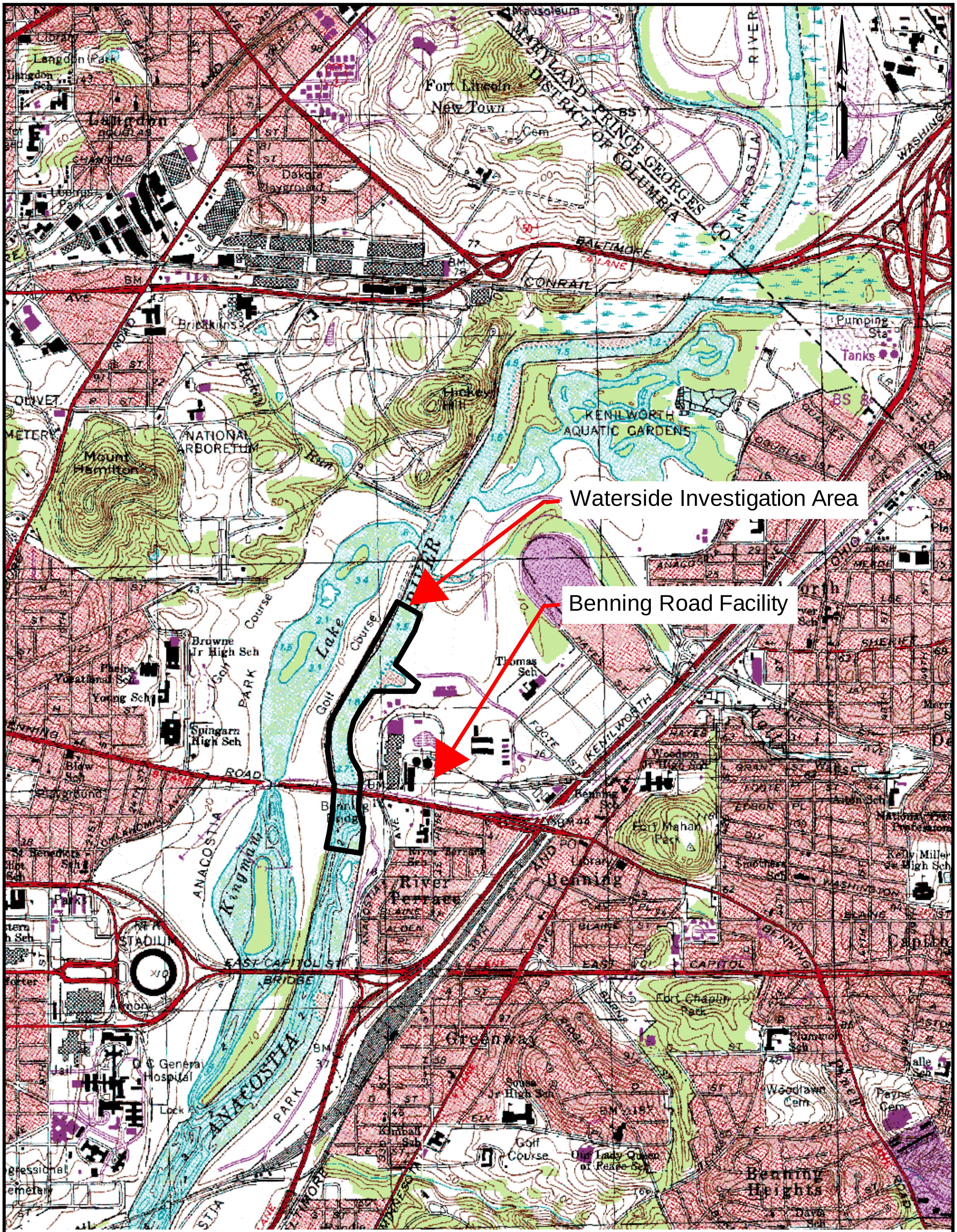
**Table 7-1**
**Weight-of-Evidence Matrix**

| Receptor | Risk Category | Risk Classification Rationale | Risk Drivers | LOE Weight | Weight for Line of Evidence |
|---|---|---|---|---|---|
| **Measurement Endpoint 1: Benthic Macroinvertebrate Community** | | | | | |
| *Evaluation of Surface Sediment COPC Concentrations relative to Screening Values* | Low Potential For Risk | -Low magnitude PEC exceedances (PEC-Q<2)<br>-Similarity to background | -Chlordane<br>-DDx<br>-Total PCBs | Low | -Media are site specific but screening values are derived from other sites<br>-Does not account for COPC bioavailability |
| *Divalent Metal Bioavailability in BAZ* | No Potential for Risk | -[Sum SEM - AVS]/$f_{oc}$ <130 umol/$g_{OC}$ | -- | Medium | -Site-specific media<br>-Accounts for bioavailability<br>-Effects data are not site-specific |
| *PAH Bioavailability in BAZ* | No Potential for Risk | -Modeling and empirical data indicate that PAHs in surface sediment are not bioavailable | -- | Medium | -Site-specific media<br>-Accounts for bioavailability<br>-Effects data are not site-specific |
| *Pore Water* | No Potential for Risk | -Ranges similar to background<br>-Few metals exceed PEC<br>-ΣEqPTU Porewater <1 | -Barium, manganese | High | -Site-specific media<br>-Accounts for bioavailability<br>-Effects data highly conservative |
| *Midge and Amphipod Toxicity Testing* | Indeterminate/ Low Potential for Risk | -Growth and survival similar among Cove, channel and background areas for both species<br>-Small deviations from laboratory controls for one endpoint<br>-Weak association between one endpoint and COPC concentrations, grain size | -Grain size<br>-DDx, PCB PEC-Q<br>-PAH ESBTU | Medium | -Site-specific media<br>-Sublethal and lethal endpoints<br>-Laboratory organisms and exposure |
| *Benthic Community* | No Potential for Risk | Site community metrics indicate community structure similar to or better than background | -- | High | -Site-specific media<br>-Site-specific receptors and effects data |
| **Measurement Endpoint 2: Fish Community** | | | | | |
| *Surface Water Screening Evaluation* | No Potential for Risk | -Few exceedances of water quality standards | -Barium, DDT, anthracene, pyrene | Low | -Media are site specific<br>-Screening values are derived from other sites |
| *Ground Water* | No Potential for Risk | -No exceedances of water quality standards | -- | Medium | -Media are site specific<br>-Screening values derived from other sites<br>-Exposure assumption highly conservative |

**Table 7-1**
**Weight-of-Evidence Matrix**

| Receptor | Risk Category | Risk Classification Rationale | Risk Drivers | LOE Weight | Weight for Line of Evidence |
|---|---|---|---|---|---|
| *Critical Body Residues* | No Potential for Risk | -Tissue concentration within range of NOECs. | -- | Medium | -Media collected from Anacostia River<br>-Effects data are derived from other sites and species |
| **Measurement Endpoint 3: Wildlife** | | | | | |
| Raccoon | No Potential for Risk | -NOAEL-HQs<1<br>-Similar to background | -- | Medium | -Site-specific media<br>-Effects data from other studies |
| Kingfisher | No Potential for Risk | -NOAEL-HQs<1<br>-Similar to background | -- | Medium | -Site-specific media<br>-Effects data from other studies |
| Great Blue Heron | No Potential for Risk | -NOAEL-HQs<1<br>-Similar to background | -- | Medium | -Site-specific media<br>-Effects data from other studies |

# Figures




AECOM

Source:
USGS 7.5 Minute Topographic Map
Washington East Quadrangle

0 1000 2000 4000
SCALE IN FEET

Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

Site Location Map

DATE: 03/11/2015 | DRAWN BY: LAD | CHECKED BY: RD

FIGURE 1-1

File: P:\Environment Projects\60249055 - PEPCO - Benning Rd Facility\Site Plan_Dec 2014.dwg Layout: Site plan User: DeskinsL Plotted: Dec 27, 2014 - 5:49pm Xref's:


LEGEND:

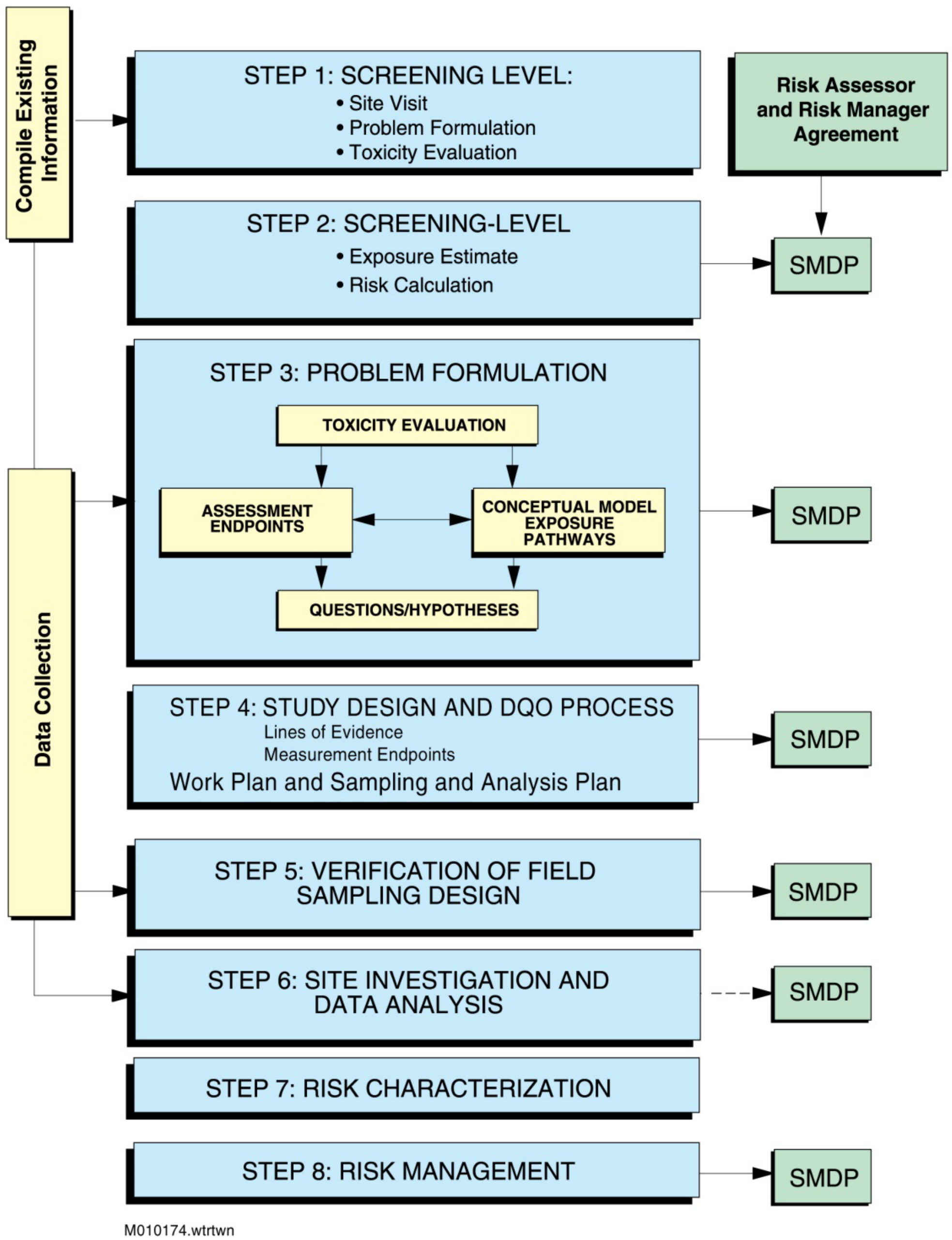
- PROPOSED INVESTIGATION AREA
- BENNING ROAD FACILITY PROPERTY BOUNDARY
- PROPERTY BOUNDARY
- EMERGENT WETLANDS

0 100 200 400
SCALE IN FEET

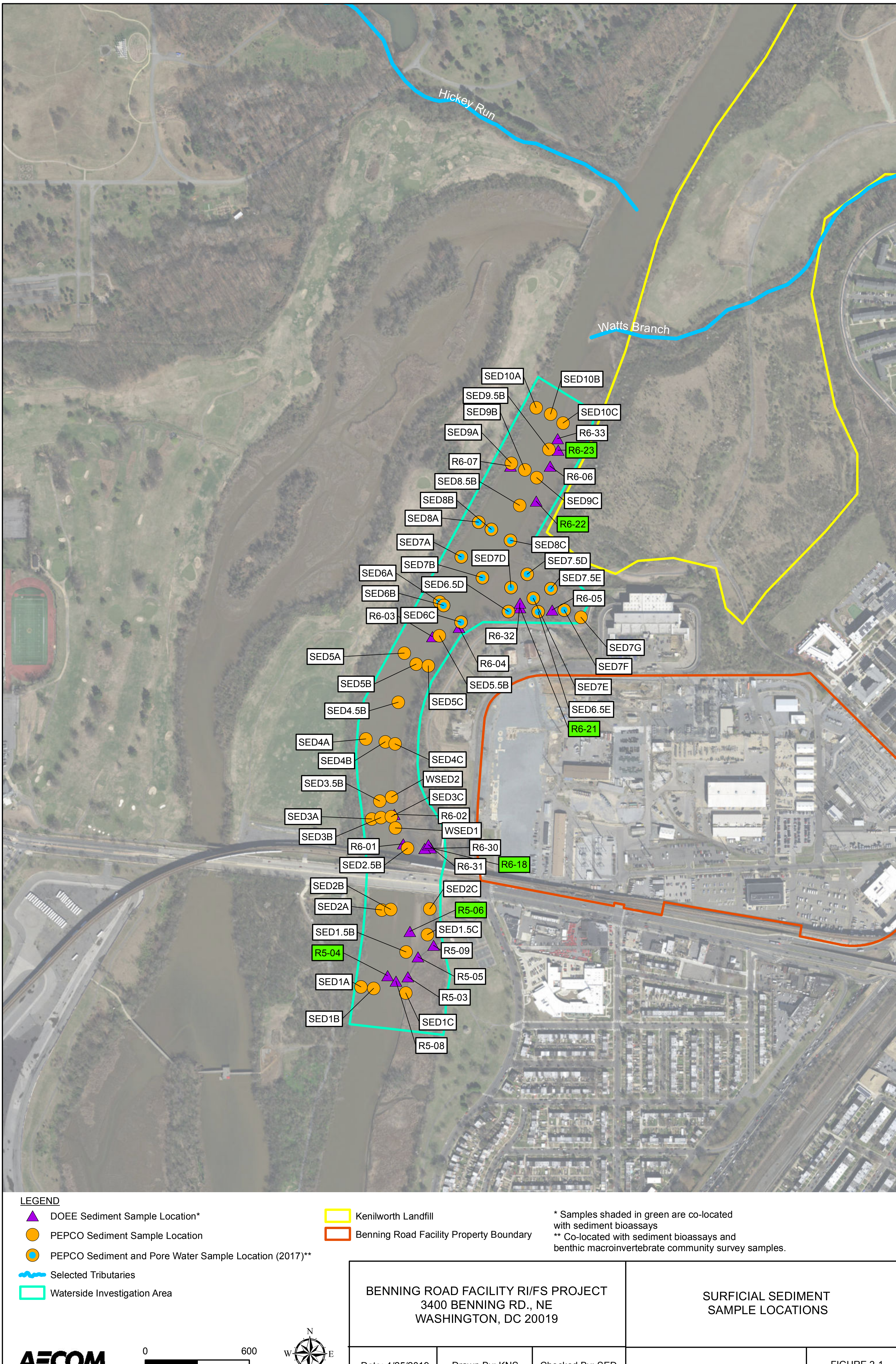
AECOM

| Benning Road Facility RI/FS Project<br>3400 Benning Rd., NE<br>Washington, DC 20019 | | | Site Plan<br>And Investigation Areas |
|---|---|---|---|
| DATE: 12/27/2014 | DRAWN: LAD | CHECKED BY: RD | FIGURE 1-2 |

**Figure 1-3**
**Eight Step Process for Ecological Risk Assessment for Superfund**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

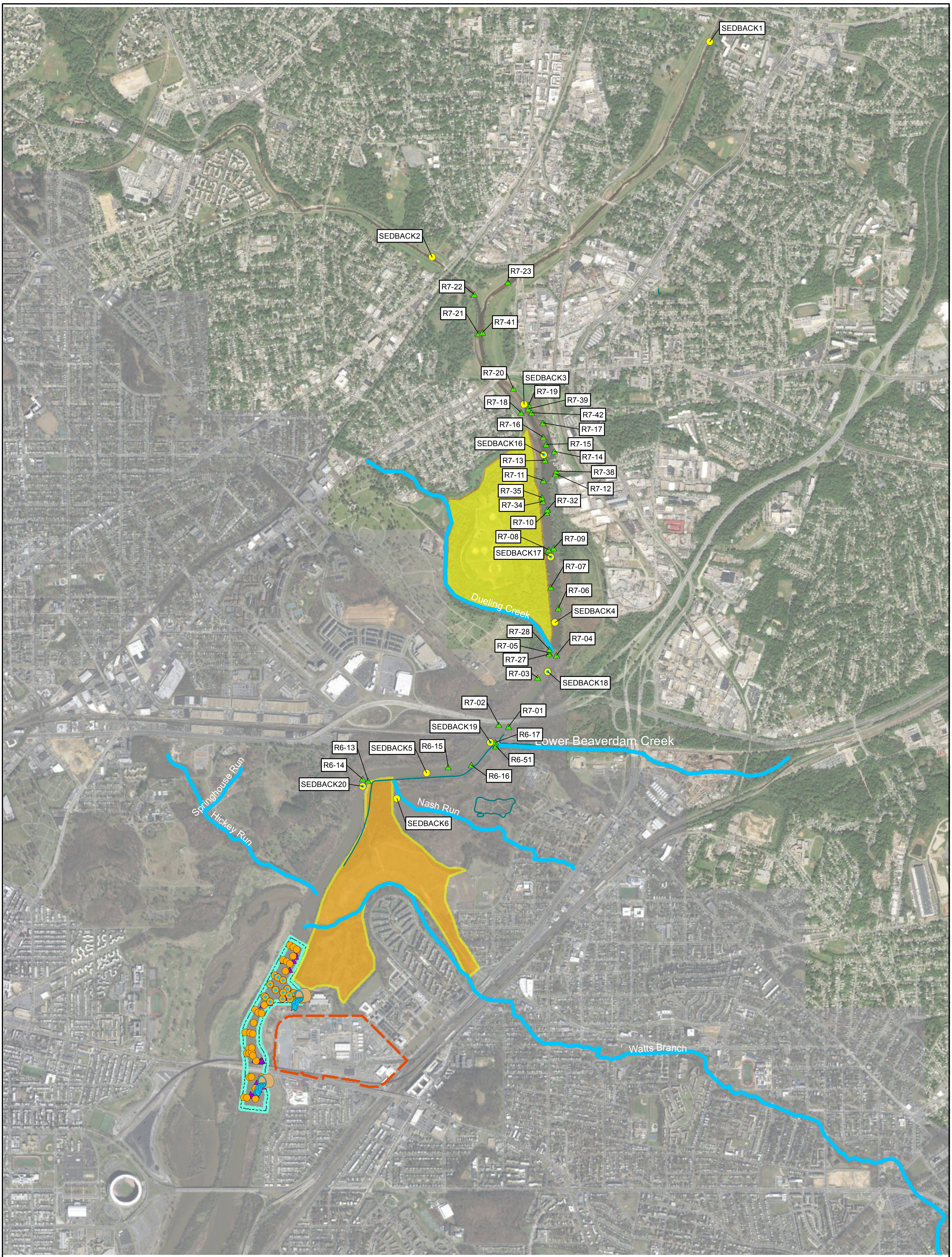



Notes:
SMDP – Scientific Management Decision Point.
Figure obtained from USEPA (1997).




AECOM

| BENNING ROAD FACILITY RI/FS PROJECT<br>3400 BENNING RD., NE<br>WASHINGTON, DC 20019 | | | SURFICIAL SEDIMENT<br>SAMPLE LOCATIONS | |
|---|---|---|---|---|
| Date: 4/25/2019 | Drawn By: KNS | Checked By: SED | | FIGURE 2-1 |




LEGEND

- Pepco Sediment and Pore Water Background Location (2017)*
- Pepco 2013 Background Location - Co-located Sediment/Surface Water
- DOEE Background Location - Sediment
- Pepco Sediment and Pore Water Sample Location (2017)*
- Pepco Sediment Sample Location
- DOEE Sediment Sample Location
- Outfalls
- Selected Tributaries
- Benning Road Facility Property Boundary
- Colmar Manner Landfill
- Kenilworth Landfill
- Waterside Investigation Area

*Co-located with sediment bioassays and benthic macroinvertebrate community survey samples.

AECOM

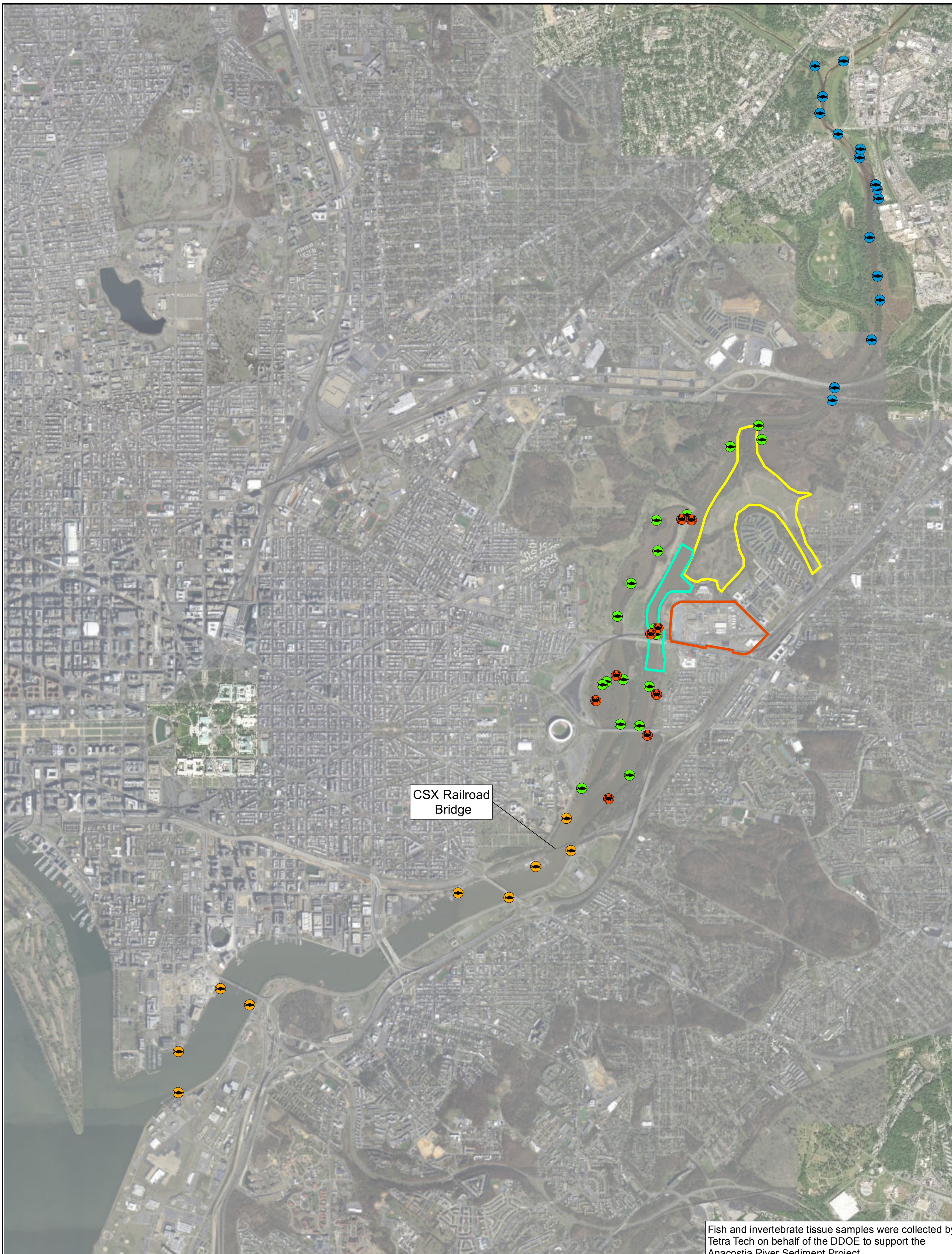
0 1,500
Feet

N
W E
S

BENNING ROAD FACILITY RI/FS PROJECT
3400 BENNING RD., NE
WASHINGTON, DC 20019

BACKGROUND AND SITE SAMPLE LOCATIONS

| Date: 4/25/2019 | Drawn By: KNS | Checked By: SED | | FIGURE 2-2 |
|---|---|---|---|---|




LEGEND

- Fish Tissue Sample Locations Selected to Represent Downstream Conditions
- Invertebrate Tissue Sample Locations Selected to Represent Site Conditions
- Fish Tissue Sampling Locations Selected to Represent Site Conditions
- Fish Tissue Sampling Locations Selected to Represent Site Conditions
- Waterside Investigation Area
- Kenilworth Landfill
- Benning Road Facility Property Boundary

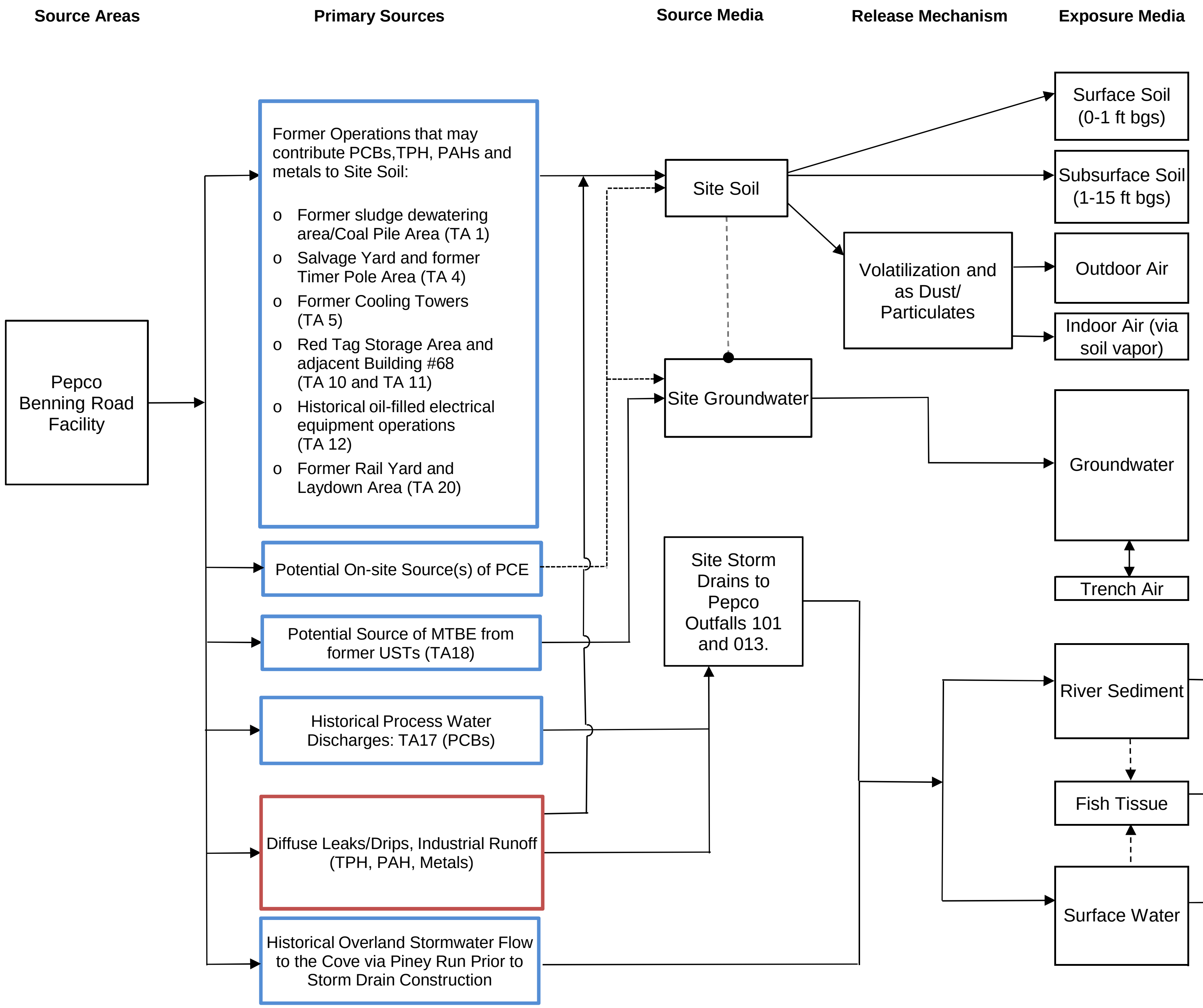
AECOM

0 2,500 Feet

N W E S

| BENNING ROAD FACILITY RI/FS PROJECT<br>3400 BENNING RD., NE<br>WASHINGTON, DC 20019 | | | FISH AND INVERTEBRATE<br>TISSUE SAMPLE LOCATIONS | |
|---|---|---|---|---|
| Date: 4/30/2019 | Drawn By: KNS | Checked By: SED | | FIGURE 2-3 |

Document Path: \\USCHL1FP001\Data\Projects\Jobs\WaterQA_Group\Pepco\GIS\MXD\2018Revisions\Figure_2_3_FishTissue_Rev_Copy.mxd




| Exposure Media | Potential Exposure Route | Potential Ecological Receptors/Exposure Pathways: Benthic Invertebrate Community | Fish Community | Avian and Mammalian Communities |
|---|---|---|---|---|
| Surface Soil (0-1 ft bgs) | | | | |
| Subsurface Soil (1-15 ft bgs) | | | | |
| Outdoor Air | | | | |
| Indoor Air (via soil vapor) | | | | |
| Groundwater | | | | |
| Trench Air | | | | |
| River Sediment | Incidental Ingestion | ● | ● | ● |
| | Dermal/Direct Contact | ● | ● | o |
| Fish Tissue | Ingestion | o | o | ● |
| Surface Water | Incidental Ingestion | ● | ● | ● |
| | Dermal/Direct Contact | ● | ● | o |

Notes:

bgs - Below ground surface.

Potential historical/former source

Potential historical/current source

Potentially complete pathway.

Unconfirmed pathway.

Insignificant pathway

Does not apply

● Potentially complete exposure pathway.

o Exposure Pathway considered to be incomplete or insignificant.

-- Not Applicable.

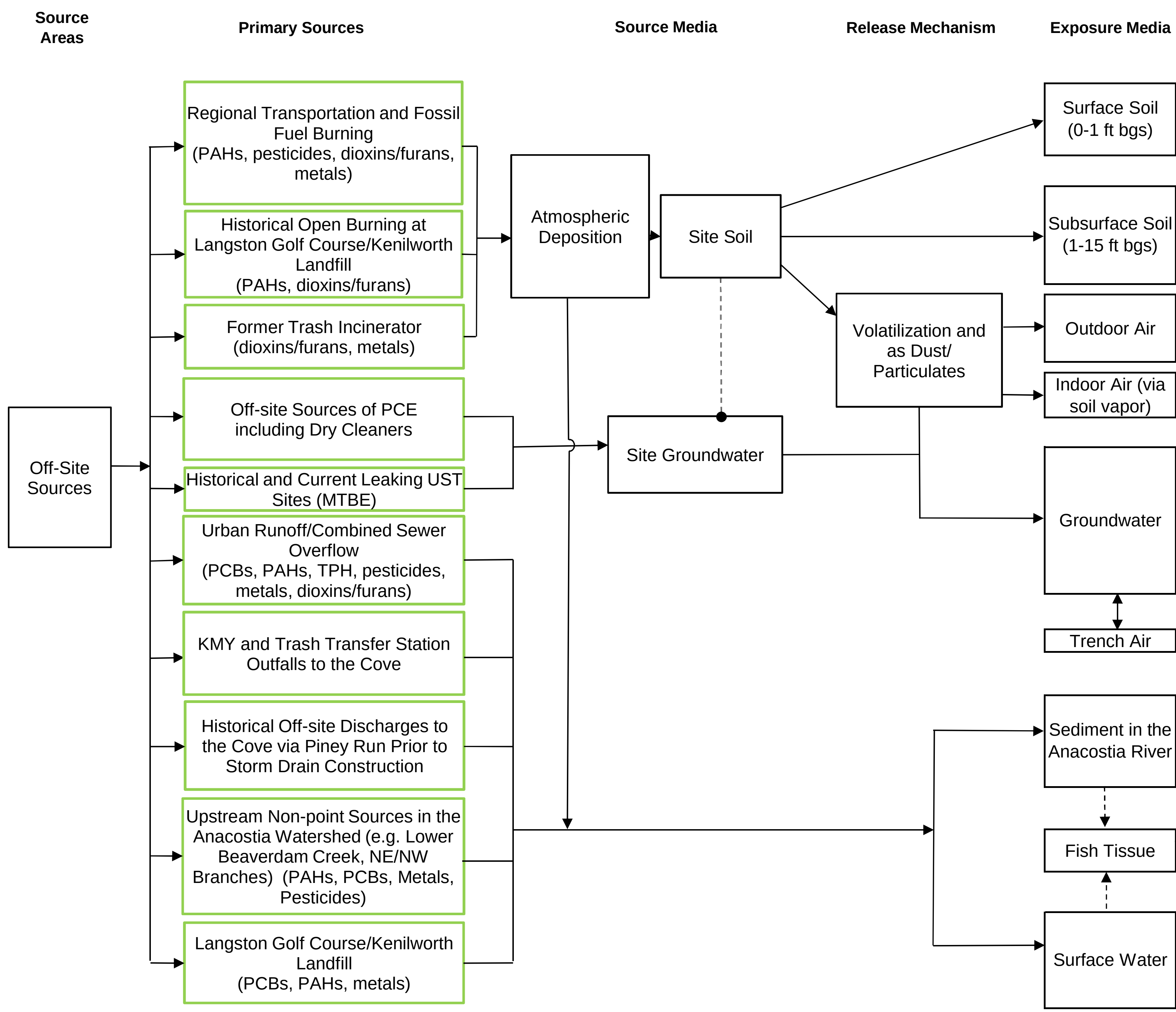
AECOM

Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

Conceptual Site Model
On-Site Sources
Waterside Investigation Area
Ecological Risk Assessment

DATE: 5/2/18

**FIGURE 3-1a**




**Potential Ecological Receptors/Exposure Pathways**

| Exposure Media | Potential Exposure Route | Benthic Invertebrate Community | Fish Community | Avian and Mammalian Communities |
|---|---|---|---|---|
| Surface Soil (0-1 ft bgs) | | | | |
| Subsurface Soil (1-15 ft bgs) | | | | |
| Outdoor Air | | | | |
| Indoor Air (via soil vapor) | | | | |
| Groundwater | | | | |
| Trench Air | | | | |
| Sediment in the Anacostia River | Incidental Ingestion | ● | ● | ● |
| | Dermal/Direct Contact | ● | ● | o |
| Fish Tissue | Ingestion | o | o | ● |
| Surface Water | Incidental Ingestion | ● | ● | ● |
| | Dermal/Direct Contact | ● | ● | o |

Notes:
bgs - Below ground surface.
Potentially complete pathway.
Unconfirmed pathway.
Insignificant pathway
Does not apply

KMY Kenilworth Maintenance Yard
● Potentially complete exposure pathway.
o Exposure Pathway considered to be incomplete or insignificant.
-- Not Applicable.

AECOM

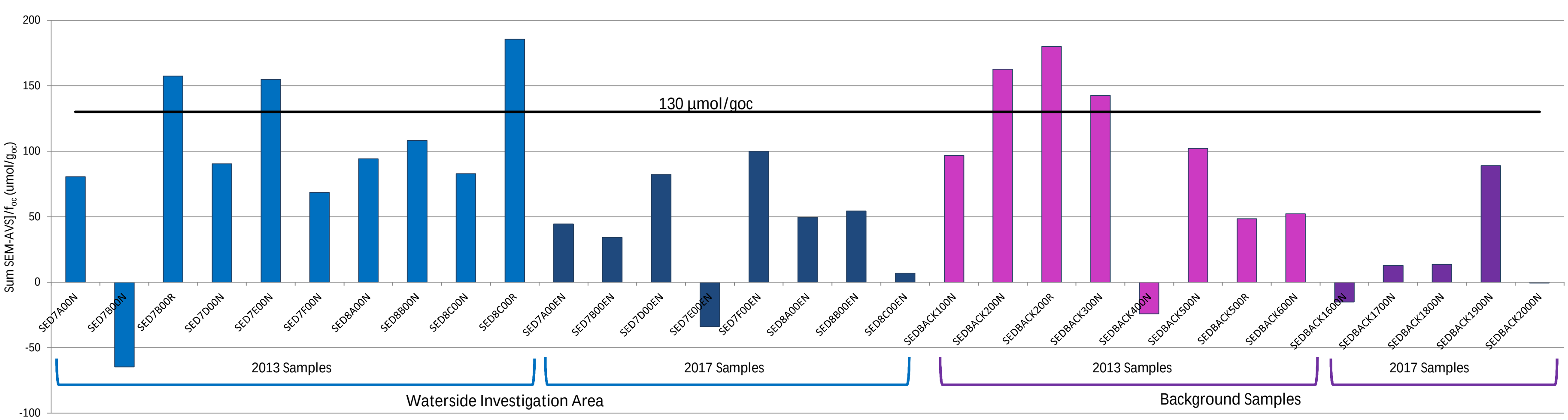
Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

Conceptual Site Model - Off-site Sources
Waterside Investigation Area
Ecological Risk Assessment

DATE: 5/2/19

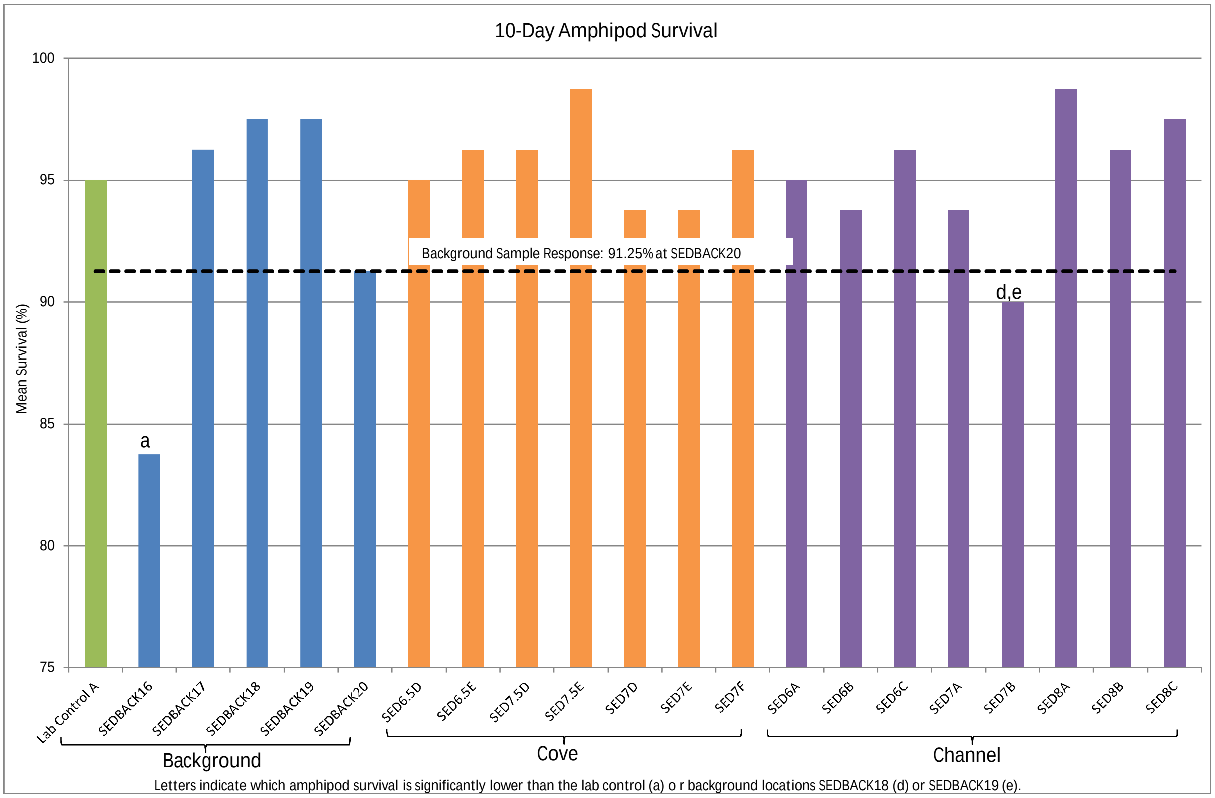
**FIGURE 3-1b**

# Figure 4-1
## Evaluation of SEM and AVS




Notes:
umol/goc - micromole per gram organic carbon
If the (∑SEM-AVS)/foc exceeds 3000 µmol/goc, the sediments are presumed "likely to be toxic";
If the (∑SEM-AVS)/foc is between 130 and 3,000 µmol/goc, predictions of effects are uncertain; and
If the (∑SEM-AVS)/foc is less than 130 µmol/goc, the sediments are presumed to "not likely" be toxic.

Figure 4-2
10-Day Amphipod Survival and Growth Results



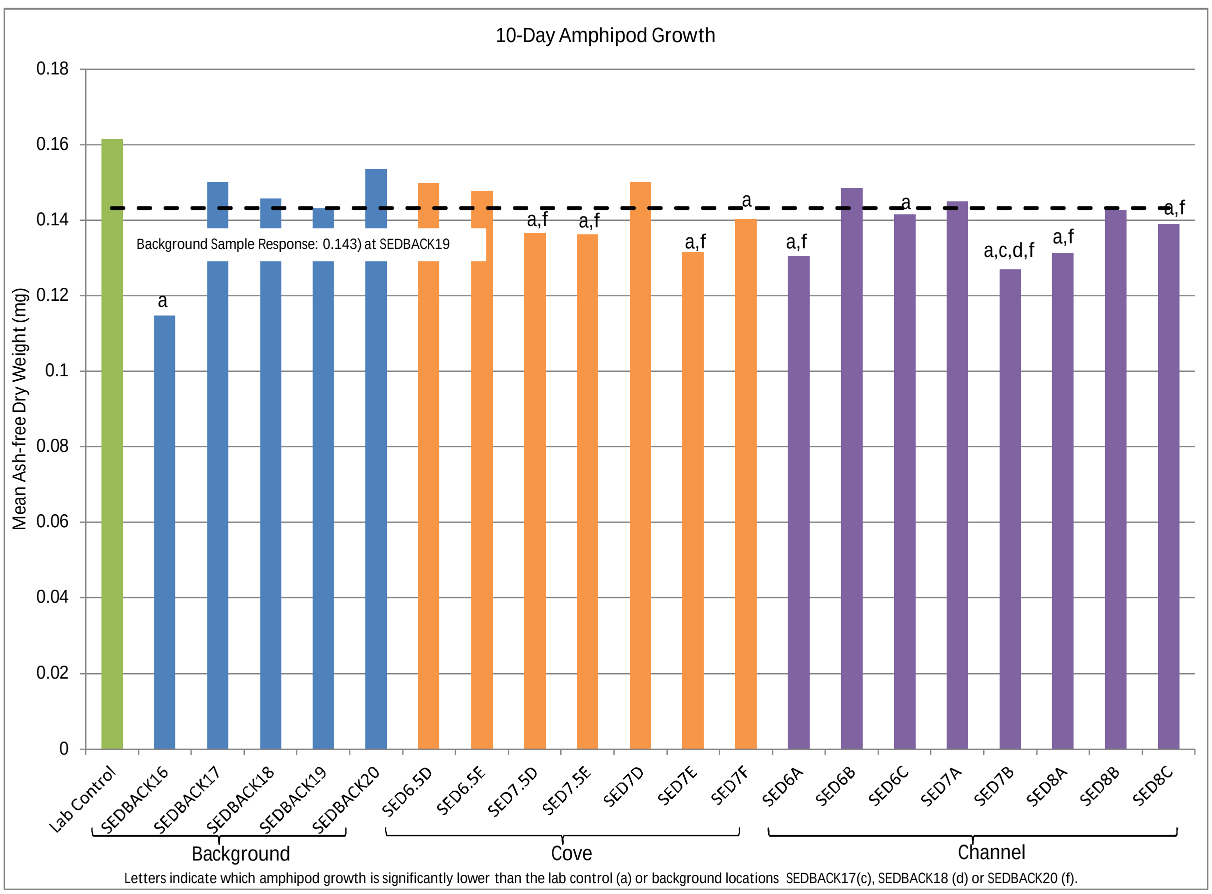
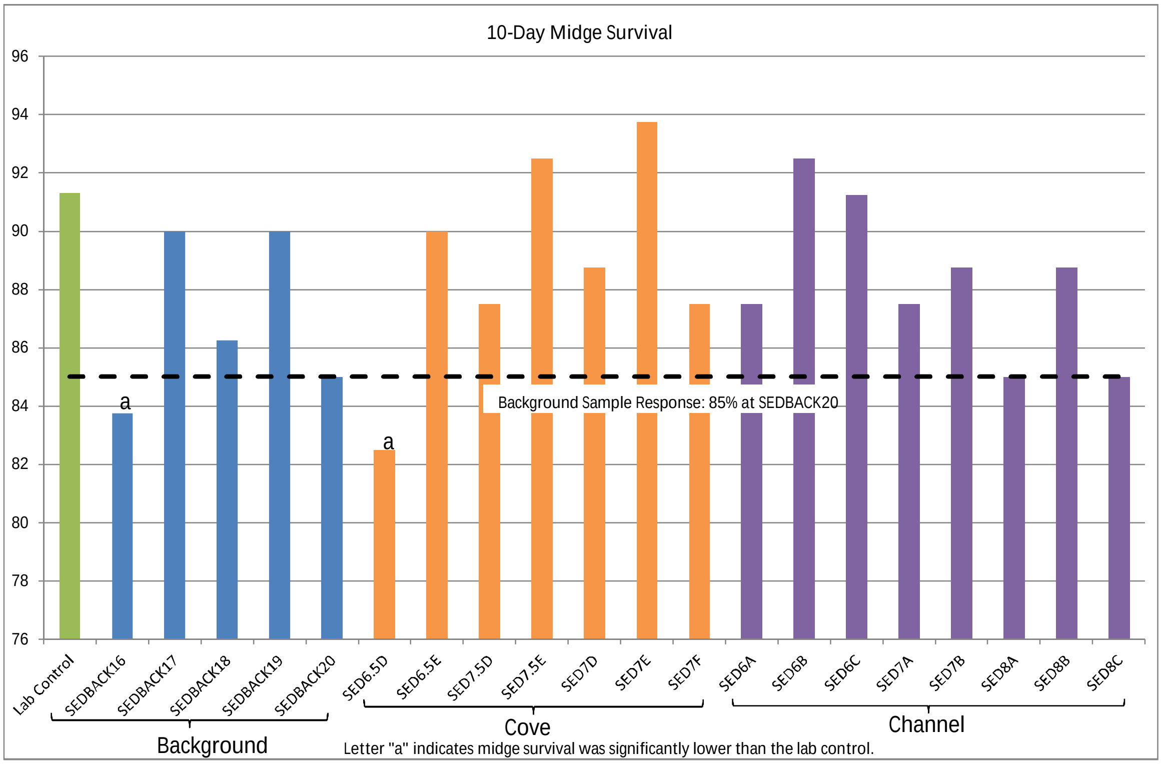



Figure 4-3
10-Day Midge Survival and Growth Results



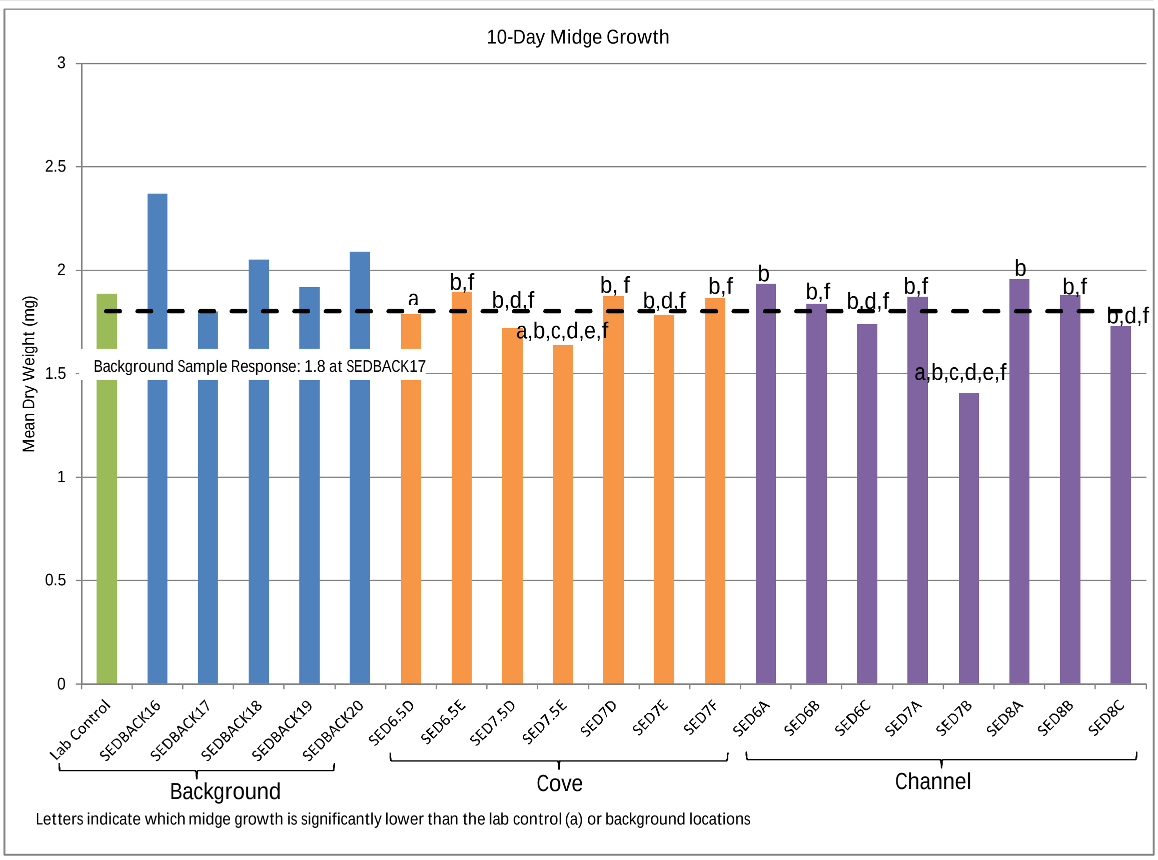
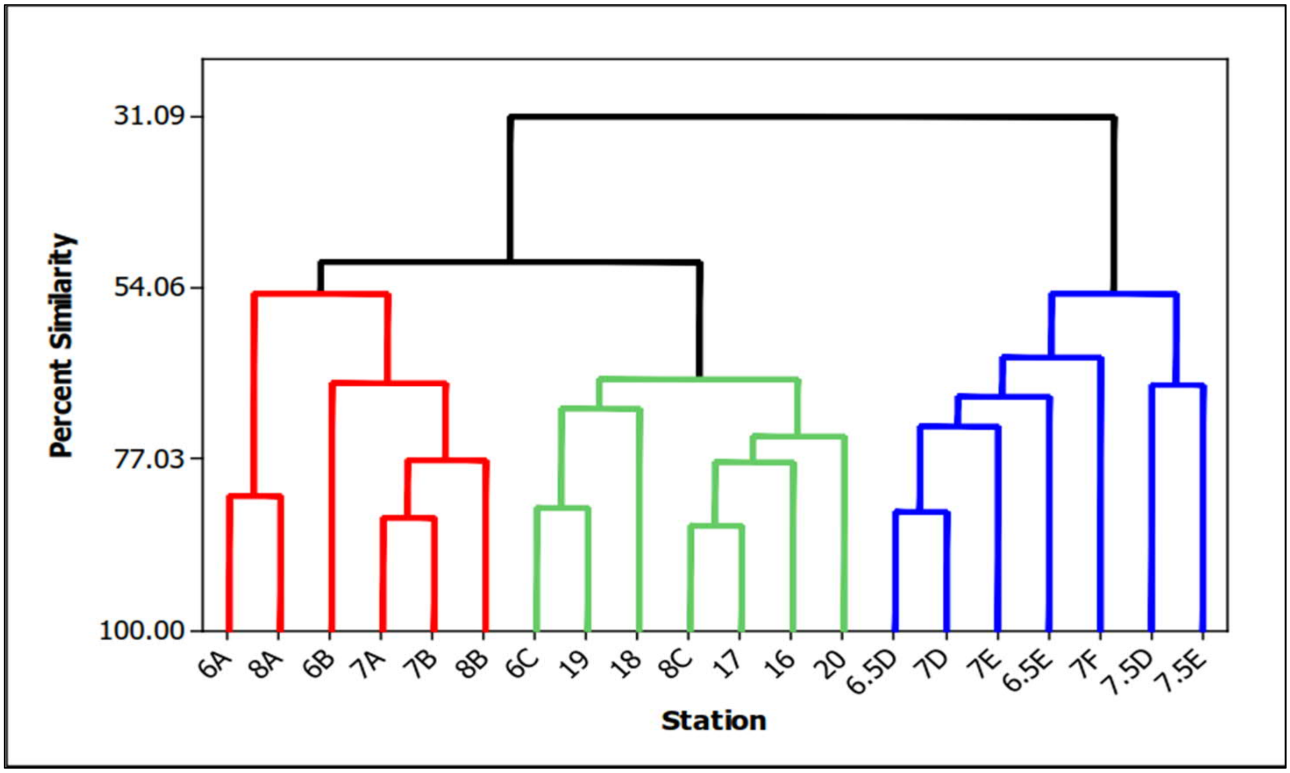
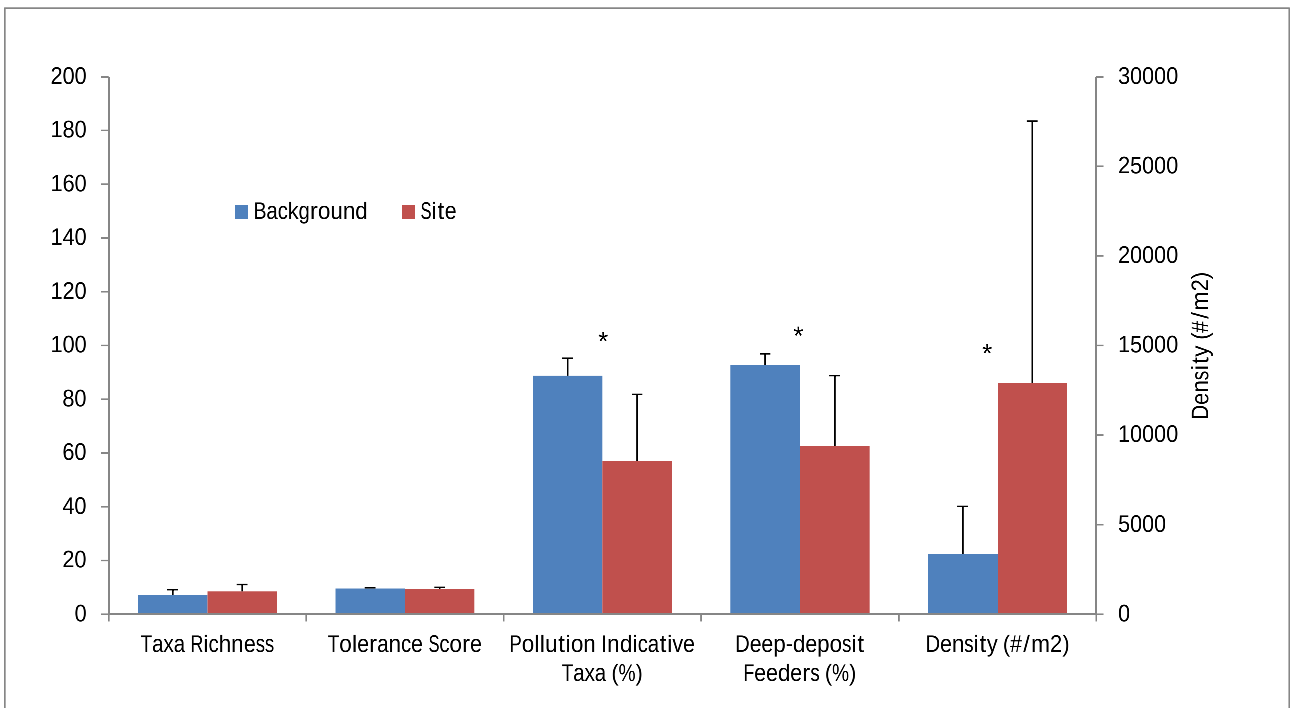



Figure 4-4
Comparisons of Benthic Macroinvertebrate Community Metrics Between Site and Background Samples

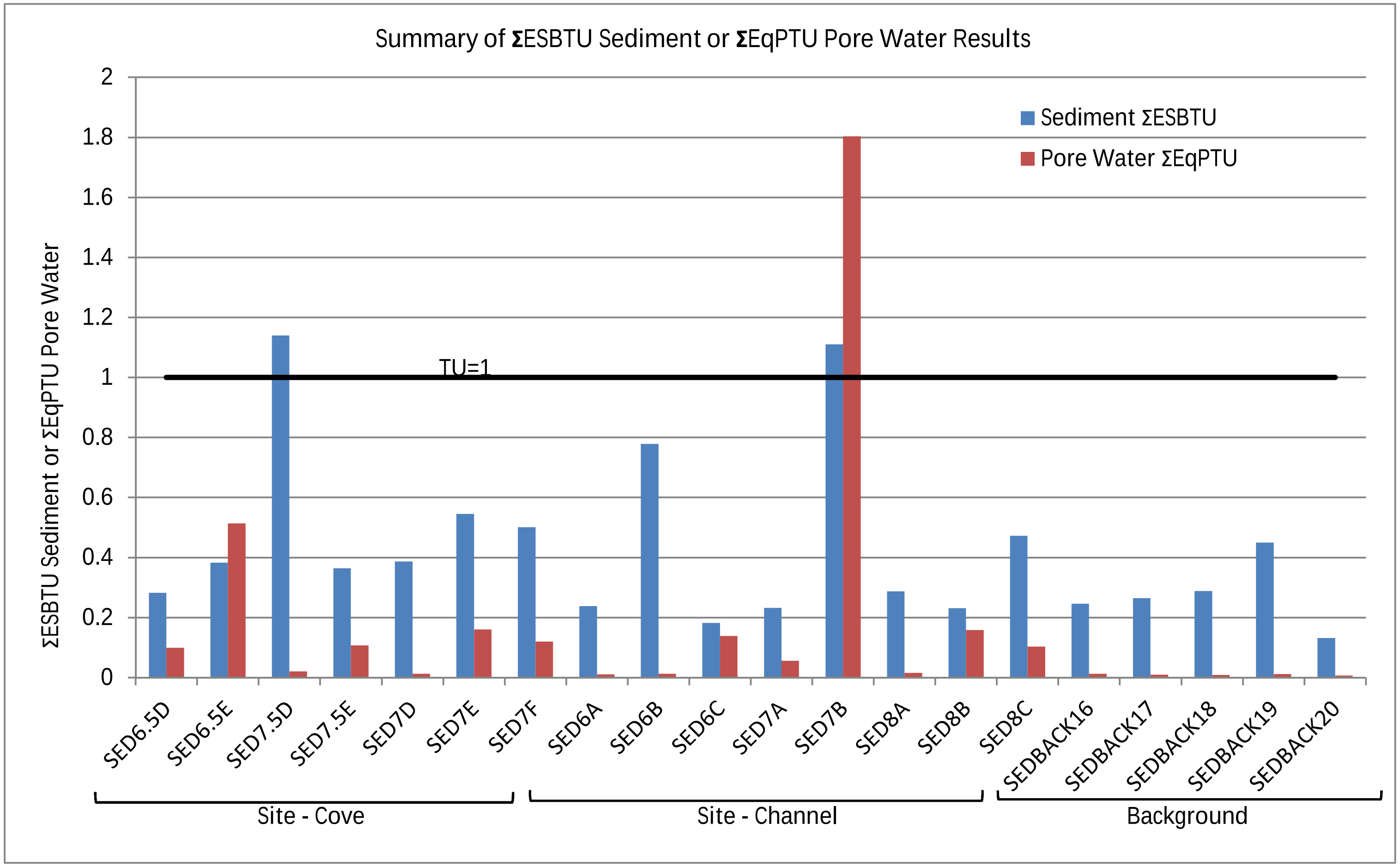



A dendrogram is used to group the sample locations according to similarity. Sample locations with a letter are Site samples (e.g., 6A is SED6A) and sample locations 16 through 20 are backgroun locations (e.g., 19 is SEDBACK19).




* Indicates significant difference (p<0.05) between Site and background samples.

FIGURE 4-5
RESULTS OF **Σ**ESBTU FOR SEDIMENT AND **Σ**EqPTU FOR PORE WATER



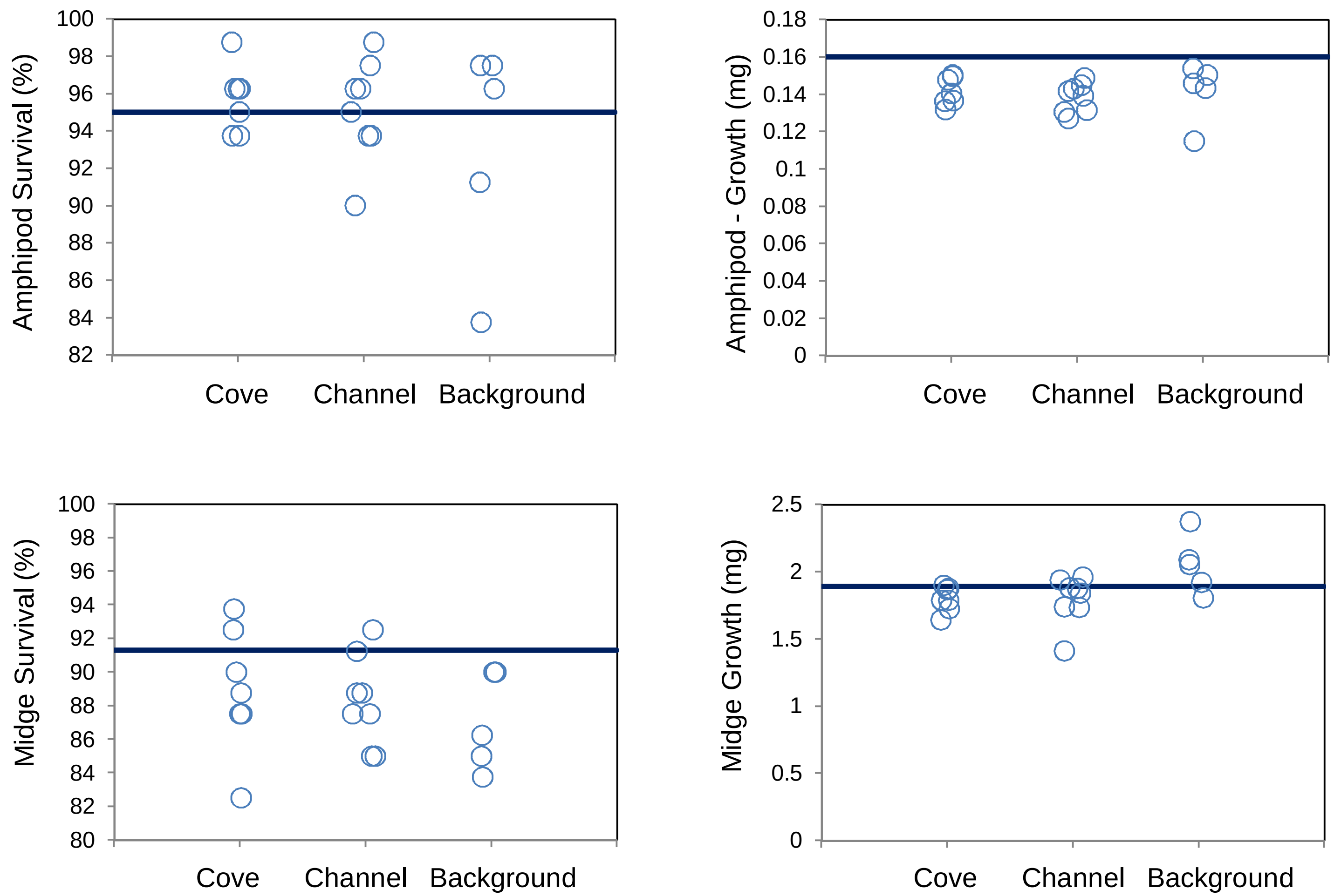



Figure 5-1. Growth and Survival of Amphipods and Midge Exposed to Sediment Samples Collected From The Cove, Channel and Background Areas. (Solid lines are the respective laboratory controls.)

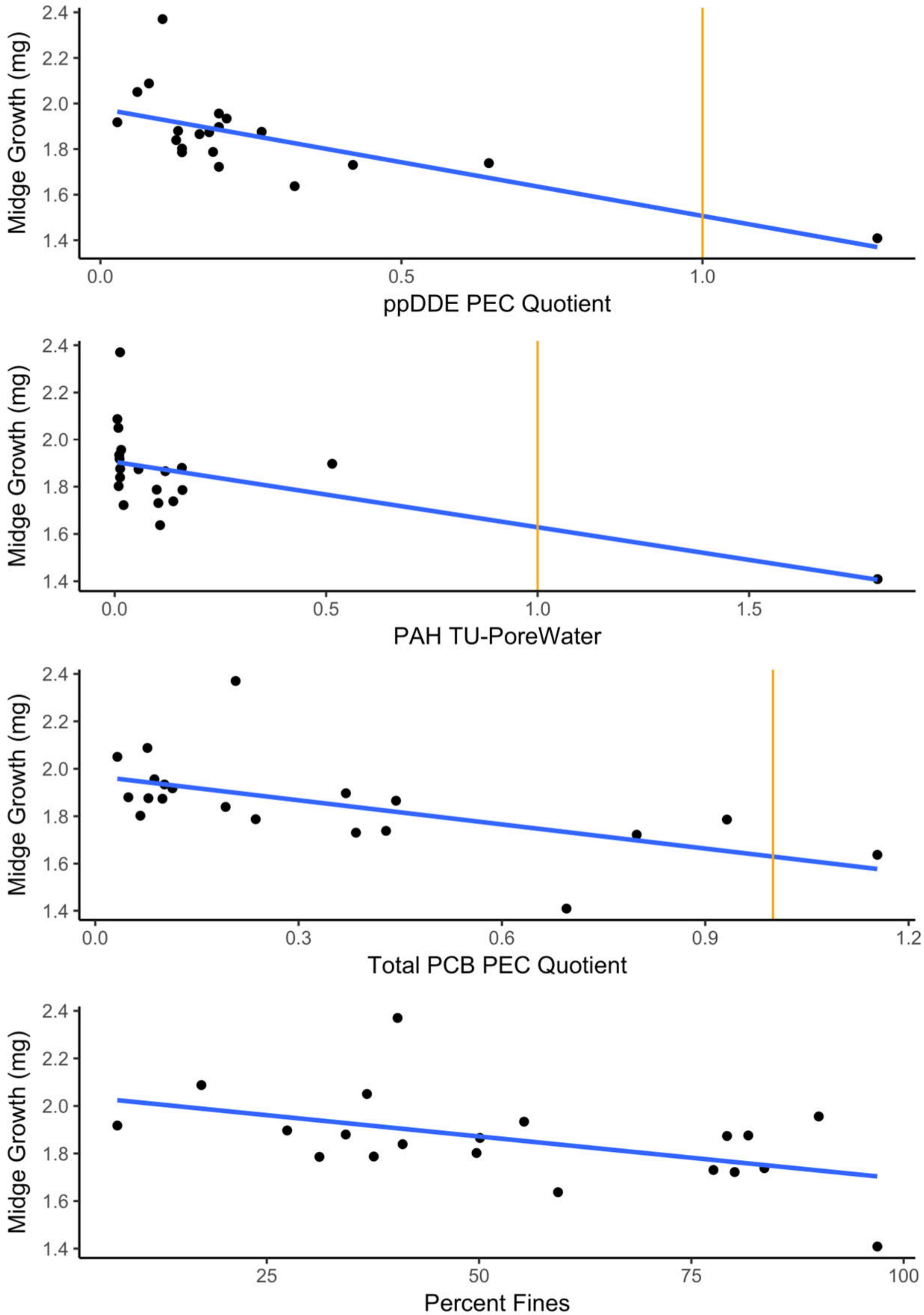
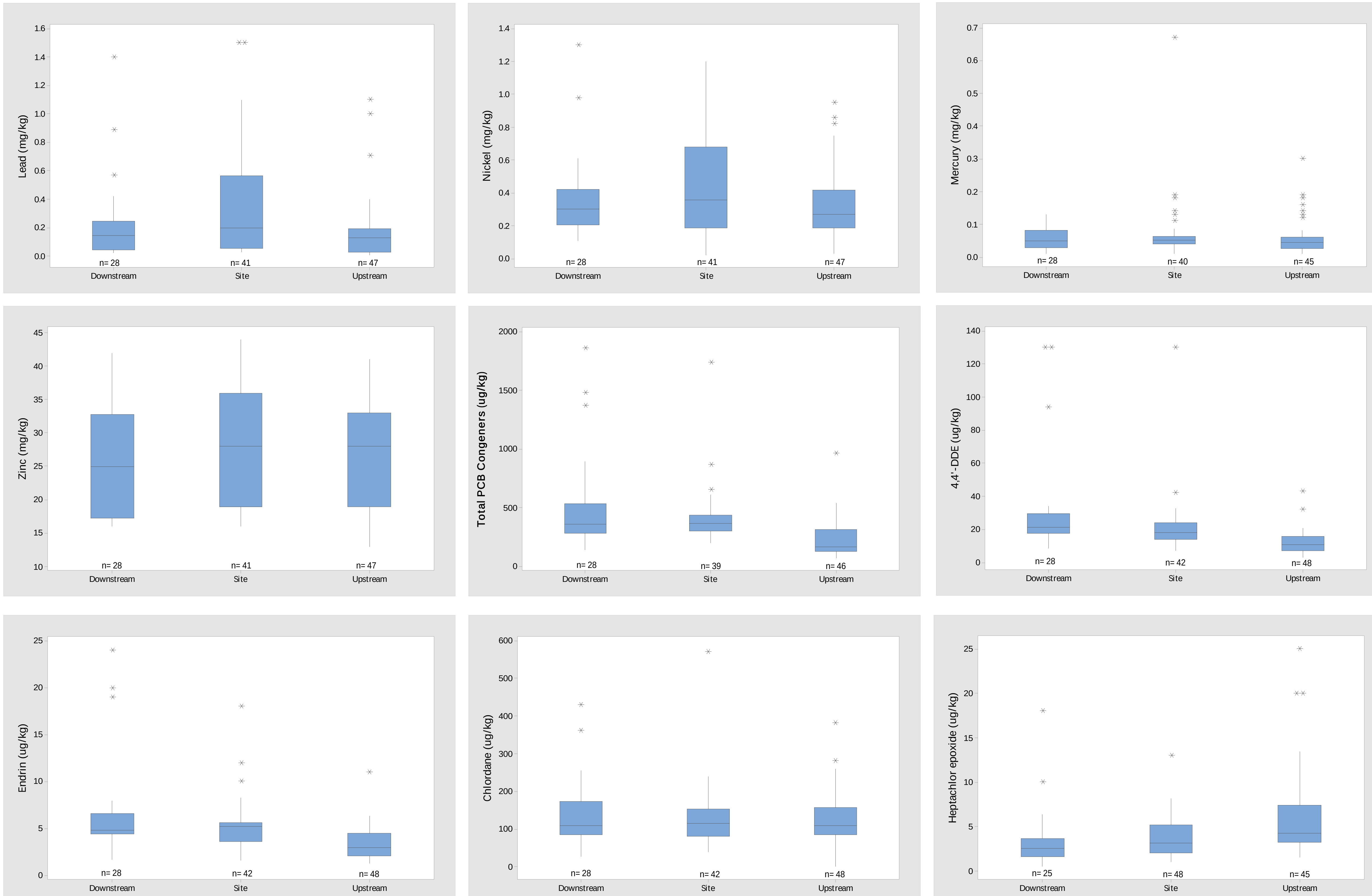



Figure 5-2. Correlations of Midge Growth with Physical (Percent Fines) and Chemical Parameters (PEC-Qs of total PCB Aroclors and 4,4'-DDE and PAH Toxic Units in Sediment Pore Water).

**Figure 5-3**
**Comparison of COPCs in Whole Body Fish Tissue Samples**




Whole body fish tissue samples were collected by Tetra Tech for the ARSP (DOEE, 2018). "Site" samples were collected in an approximately 2-8-mile area centered on the Waterside Investigation Area from the CSX Bridge to Kenilworth Park Landfill, including Kingman Lake. "Downstream" samples were collected downstream of the CSX Bridge and "Upstream" samples were collected upstream of the Kenilworth Park Landfill.

# Attachment A

# Analytical Data Considered in the ERA

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | R5-03 | R5-04 | R5-05 | R5-06 | R5-08 | R5-09 | R6-01 | R6-02 | R6-03 | R6-04 | R6-04 | R6-05 |
| | | Sample ID | RI-R5-03-SS | RI-R5-04-SS | RI-R5-05-SS | RI-R5-06-SS | P2-R5-08-SS | P2-R5-09-SS | RI-R6-01-SS | RI-R6-02-SS | RI-R6-03-SS | RI-R6-04-SS | RI-R6-80-SS | RI-R6-05-SS |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | FD | N |
| | | Sample Date | 7/25/2014 | 7/28/2014 | 7/30/2014 | 4/30/2015 | 6/9/2016 | 6/28/2016 | 8/5/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 8/4/2014 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | | 3.3E-05 J | | 1.1E-05 J | 3.5E-05 | 2.2E-05 J | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | | 0.00019 | | 6.6E-05 | 0.00017 | 0.00012 | | | | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | | 3E-06 J | | 1E-06 J | 4E-06 U | 1.7E-06 J | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | | 5.1E-06 J | | 2.3E-06 J | 1.1E-05 | 3.1E-06 J | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | | 3.5E-06 J | | 1.9E-06 J | 7E-06 | 2.3E-06 J | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | | 5.4E-06 J | | 2.5E-08 U | 7E-06 | 2.3E-06 J | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | | 7.4E-06 J | | 4E-06 J | 1.3E-05 | 5.1E-06 | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | | 7.6E-08 U | | 1.3E-07 J | 6.3E-07 U | 5.9E-08 U | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | | 1E-05 J | | 4.9E-06 | 1.7E-05 | 5.9E-06 | | | | | | |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | | 1.2E-06 J | | 9.3E-07 J | 3.2E-06 J | 6.3E-07 J | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | | 2.4E-06 J | | 3.4E-06 J | 5.3E-06 J | 1.5E-06 J | | | | | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | | 3.5E-06 J | | 1.4E-06 J | 6.5E-06 | 2E-06 J | | | | | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | | 3E-06 J | | 1.8E-06 J | 6.6E-06 | 1.7E-06 J | | | | | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | | 2.3E-06 J | | 1.4E-06 | 3.2E-06 J | 1.1E-06 | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | | 7.2E-07 J | | 5.2E-07 J | 1.1E-06 | 3.4E-07 J | | | | | | |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | | 7.5E-05 | | 2.2E-05 | 5.1E-05 U | 4.6E-05 | | | | | | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | | 0.0066 | | 0.0022 | 0.0042 J | 0.0034 | | | | | | |
| **Metals** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 7500 | 11000 | 8000 | 9500 | 7200 | | 4700 | 8500 | 14000 | 15500 | | 4400 |
| Antimony | 7440-36-0 | mg/kg | 0.62 J | 0.47 J | 0.39 J | 0.37 J+ | 0.62 J | | 0.49 J | 0.43 J | 0.33 J | 0.64 J | | 1.7 |
| Arsenic | 7440-38-2 | mg/kg | 3.2 J | 3.6 J | 2.3 | 2.9 | 4.4 J | | 1.9 J | 2.7 J | 6.7 J | 9.05 J | | 7.1 |
| Barium | 7440-39-3 | mg/kg | 62 | 81 | 63 | 72 | 73 | | 47 J | 61 | 86 | 105 | | 130 |
| Beryllium | 7440-41-7 | mg/kg | 0.88 | 1.1 | 0.83 | 0.82 | 0.95 | | 0.63 | 0.91 | 1.2 | 1.5 | | 0.43 |
| Cadmium | 7440-43-9 | mg/kg | 0.65 | 0.56 | 0.63 | 0.36 | 1.4 | | 0.35 J | 0.51 | 0.79 | 1.15 | | 2.8 |
| Calcium | 7440-70-2 | mg/kg | 2500 | 2900 J | 2100 | 2700 | 2100 | | 1700 J | 2600 J | 2600 J | 12000 J | | 3600 |
| Chromium | 7440-47-3 | mg/kg | 25 | 40 J | 29 | 35 | 38 J | | 18 J | 34 J | 52 J | 69 J | | 48 |
| Cobalt | 7440-48-4 | mg/kg | 11 | 15 | 10 J | 16 | 14 | | 7.8 J | 14 | 13 | 19.5 | | 6.9 |
| Copper | 7440-50-8 | mg/kg | 30 J | 40 J | 28 J | 36 | 40 | | 18 J | 34 J | 55 J | 70 J | | 64 |
| Iron | 7439-89-6 | mg/kg | 15000 | 25000 | 15000 J | 21000 | 20000 | | 11000 J | 19000 | 28000 | 28000 | | 14000 |
| Lead | 7439-92-1 | mg/kg | 48 | 49 | 46 | 42 | 120 | | 27 | 44 | 100 | 120 | | 140 |
| Magnesium | 7439-95-4 | mg/kg | 3200 | 3600 J | 3100 | 3800 | 2600 | | 1600 J | 3200 J | 3100 J | 3700 J | | 4400 |
| Manganese | 7439-96-5 | mg/kg | 170 | 340 | 180 | 240 | 270 J | | 150 | 210 | 410 | 305 | | 150 |
| Mercury | 7439-97-6 | mg/kg | 0.068 | 0.13 | 0.11 | 0.11 | 0.12 | | 0.037 | 0.086 | 0.14 | 0.22 | | 0.32 |
| Nickel | 7440-02-0 | mg/kg | 22 | 27 J | 20 | 30 | 32 | | 17 J | 25 J | 32 J | 59 J | | 110 |
| Potassium | 7440-09-7 | mg/kg | 1100 | 1500 | 1000 J | 2100 | 1100 | | 1300 | 1300 | 1400 | 1300 | | 390 |
| Selenium | 7782-49-2 | mg/kg | 0.32 J | 0.36 J | 0.19 J | 0.65 | 2.6 | | 0.18 J | 0.24 J | 0.6 | 0.875 | | 0.32 J |
| Silver | 7440-22-4 | mg/kg | 0.2 | 0.21 | 0.2 | 0.11 | 0.62 | | 0.091 J | 0.15 | 0.35 | 0.5 | | 1.2 |
| Sodium | 7440-23-5 | mg/kg | 170 J | 170 J | 140 J | 230 | 130 | | 90 | 150 J | 150 J | 300 J | | 130 |
| Thallium | 7440-28-0 | mg/kg | 0.16 | 0.18 | 0.15 | 0.22 J+ | 0.17 | | 0.13 | 0.16 | 0.2 | 0.33 | | 0.13 |
| Vanadium | 7440-62-2 | mg/kg | 33 J | 37 J | 27 J | 32 | 55 | | 16 J | 32 J | 78 J | 140 J | | 180 |
| Zinc | 7440-66-6 | mg/kg | 160 J | 180 | 140 J | 140 | 220 J | | 89 J | 150 | 190 | 285 | | 260 |
| **Other** | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | 140 U | 240 J | 180 J | 430 J | 560 | | 150 U | 150 J | 140 U | 295 J | | 270 J |
| PH | PH | ph units | 6.75 | 6.75 | 6.5 | 6.9 | 6.76 | | 6.31 | 6.26 | 6.67 | 6.26 | 6.49 | 7.17 |
| Total Organic Carbon | TOC | mg/kg | 39000 | 41000 | 37000 | 38000 | 35000 | 63000 | 20000 | 32000 | 39000 | 38000 | | 52000 |
| Total Organic Carbon | 7440-44-0 | mg/kg | | | | | | | | | | | | |
| **PCBs/Pesticides** | | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 0.0037 J | 0.0064 | 0.0045 J | 0.0035 J | 0.0075 J | | 0.0032 J | 0.0033 J | 0.0068 J | 0.0057 J | | 0.0027 J |
| 4,4'-DDE | 72-55-9 | mg/kg | 0.0067 | 0.0064 | 0.0089 | 0.0035 J | 0.014 | | 0.0045 | 0.005 | 0.02 | 0.018 | | 0.0028 J |
| 4,4'-DDT | 50-29-3 | mg/kg | 0.0011 J | 0.0015 J | 0.0013 J | 0.0015 J | 0.0027 J | | 0.0017 J | 0.0015 J | 0.0036 J | 0.038 | | 0.07 |
| Aldrin | 309-00-2 | mg/kg | 0.00041 J | 0.00071 J | 0.00053 J | 0.00052 J | 7.7E-05 U | | 0.00071 J | 0.00058 J | 0.00029 J | 0.00037 J | | 0.00022 J |
| alpha-BHC | 319-84-6 | mg/kg | 0.00013 U | 0.00016 U | 0.00013 U | 6.5E-05 U | 7E-05 U | | 6.7E-05 U | 0.00014 U | 0.00013 J | 0.00016 U | | 5.6E-05 U |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.00064 U | 0.00016 U | 0.00063 U | 0.001 U | 0.0032 U | | 0.0013 U | 0.00014 U | 0.0013 U | 0.0016 U | | 0.0011 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.048 | 0.028 | 0.063 | 0.063 J | 0.14 | | 0.046 | 0.036 | 0.32 | 0.38 | | 0.81 |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.00056 U | 0.00014 U | 0.00055 U | 0.00095 U | 0.11 | | 0.0012 U | 0.00012 U | 0.0011 U | 0.0014 U | | 0.00098 U |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | R5-03 | R5-04 | R5-05 | R5-06 | R5-08 | R5-09 | R6-01 | R6-02 | R6-03 | R6-04 | R6-04 | R6-05 |
| | | Sample ID | RI-R5-03-SS | RI-R5-04-SS | RI-R5-05-SS | RI-R5-06-SS | P2-R5-08-SS | P2-R5-09-SS | RI-R6-01-SS | RI-R6-02-SS | RI-R6-03-SS | RI-R6-04-SS | RI-R6-80-SS | RI-R6-05-SS |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | FD | N |
| | | Sample Date | 7/25/2014 | 7/28/2014 | 7/30/2014 | 4/30/2015 | 6/9/2016 | 6/28/2016 | 8/5/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 8/4/2014 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.049 | 0.025 | 0.045 | 0.028 J | 0.1 | | 0.035 | 0.022 | 0.14 | 0.6 | | 0.6 |
| beta-BHC | 319-85-7 | mg/kg | 0.0002 U | 0.00025 U | 0.0005 J | 0.0001 U | 0.00011 U | | 0.00035 J | 0.00022 U | 0.0002 U | 0.000855 J | | 0.0039 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | 0.045 | 0.054 | 0.071 | 0.035 J | 0.11 | | 0.043 J | 0.047 | 0.13 | 0.084 | | 0.00015 U |
| Chlordane (Technical) | 12789-03-6 | mg/kg | 0.045 | 0.054 | 0.071 | 0.035 J | | | 0.043 J | 0.047 | 0.13 | 0.084 | | 0.00015 U |
| cis-Chlordane | 5103-71-9 | mg/kg | | | | | | | | | | | | |
| delta-BHC | 319-86-8 | mg/kg | 0.00075 J | 0.00047 J | 0.00012 U | 0.00035 J | 6.6E-05 U | | 6.3E-05 U | 0.0004 J | 0.00012 U | 0.00015 U | | 5.3E-05 U |
| Dieldrin | 60-57-1 | mg/kg | 0.0013 J | 0.0013 J | 0.0013 J | 0.0012 J | 7.2E-05 U | | 0.0014 J | 0.001 J | 0.0042 J | 0.014 J | | 0.0048 J |
| Endosulfan I | 959-98-8 | mg/kg | 0.00015 U | 0.00018 U | 0.00015 U | 7.5E-05 U | 8.1E-05 U | | 7.7E-05 U | 0.00016 U | 0.00047 J | 0.00045 J | | 0.00074 J |
| Endosulfan II | 33213-65-9 | mg/kg | 0.00077 J | 0.00044 J | 0.00056 J | 0.0011 J | 7.6E-05 U | | 0.00061 J | 0.00035 J | 0.0022 J | 0.0068 | | 0.0042 J |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | 0.00098 | 0.0008 J | 0.0013 | 0.00081 J | 4.5E-05 U | | 0.0011 J | 0.0011 J | 0.0045 | 0.00355 J | | 0.011 |
| Endrin | 72-20-8 | mg/kg | 0.0021 J | 0.0027 | 0.0041 | 0.00089 J | 0.0036 J | | 0.0031 J | 0.0015 J | 0.0088 J | 0.00765 J | | 0.021 J |
| Endrin aldehyde | 7421-93-4 | mg/kg | 0.00039 J | 0.00025 J | 0.00015 U | 7.7E-05 U | 8.3E-05 U | | 0.00033 J | 0.00016 J | 0.00053 J | 0.00075 J | | 0.0015 J |
| Endrin ketone | 53494-70-5 | mg/kg | | | | | | | | | | | | |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | 0.00016 J | 0.00028 J | 0.00024 J | 8.4E-05 J | 0.00052 | | 7.2E-05 U | 0.00018 J | 0.00047 J | 0.00027 U | | 0.00066 J |
| Heptachlor | 76-44-8 | mg/kg | 0.00069 J | 0.001 | 0.0012 J | 0.00065 J | 9.5E-05 U | | 0.00058 J | 0.001 | 0.0032 J | 0.0033 J | | 0.00097 J |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | 0.00061 J | 0.00065 J | 0.00067 J | 0.00047 J | 8.3E-05 U | | 0.00099 J | 0.0006 J | 0.0041 J | 0.0033 J | | 0.0065 J |
| Methoxychlor | 72-43-5 | mg/kg | | | | | | | | | | | | |
| PCB, TOTAL | PCB | mg/kg | | | | | | | | | | | | |
| PCB, Total Congeners | TOTCONG | mg/kg | 0.16 | 0.19 | 0.24 | 0.1 | 0.47 | 0.1 | 0.1 | 0.28 | 1 | 3.711 | | 1.3 |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.097 | 0.053 | 0.11 | 0.091 | 0.35 | | 0.081 | 0.058 | 0.46 | 0.98 | | 1.4 |
| trans-Chlordane | 5103-74-2 | mg/kg | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | | | | | | | | | | | | |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | 0.049 U | 0.12 U | 0.049 U | 0.05 U | 0.054 U | | 0.077 U | 0.1 U | 0.048 U | 0.12 U | | 0.065 U |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | mg/kg | | | | | | | | | | | | |
| 4-Methylphenol | 106-44-5 | mg/kg | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | mg/kg | 0.051 J | 0.027 J | 0.061 J | 0.06 J | 0.0066 U | | 0.087 J | 0.032 J | 0.036 J | 0.051 J | | 0.43 |
| Acenaphthylene | 208-96-8 | mg/kg | 0.12 | 0.076 J | 0.076 | 0.073 | 0.073 | | 0.047 J | 0.085 J | 0.051 J | 0.1 J | | 0.051 J |
| Acetophenone | 98-86-2 | mg/kg | | | | | | | | | | | | |
| Anthracene | 120-12-7 | mg/kg | 0.16 | 0.11 J | 0.2 | 0.23 | 0.12 | | 0.2 | 0.16 | 0.093 | 0.105 J | | 0.86 |
| Benzaldehyde | 100-52-7 | mg/kg | | | | | | | | | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.8 | 0.44 | 0.85 | 1.3 | 0.36 | | 0.74 | 0.67 | 0.41 | 0.35 | | 2.3 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 0.94 | 0.6 J | 0.99 | 1.4 | 0.39 | | 0.76 | 0.79 | 0.43 | 0.43 | | 2 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 1.4 | 0.83 J | 1.4 | 1.9 | 0.57 | | 1 | 1.2 | 0.6 | 0.65 | | 2.6 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 1.2 | 0.74 J | 1.2 | 1.6 | 0.49 | | 0.75 | 0.85 | 0.42 | 0.515 | | 1.7 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.43 | 0.34 J | 0.59 | 0.75 | 0.22 | | 0.37 | 0.37 | 0.23 | 0.295 | | 0.96 |
| Benzoic acid | 65-85-0 | mg/kg | 0.13 U | 1.4 J | 0.13 U | 0.96 J | 0.14 U | | 0.2 U | 1.2 J | 0.13 U | 1.2 J | | 0.17 U |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | 1.9 | 1.3 J | 1.6 | 1.1 | 1.3 | | 0.59 J | 0.97 J | 0.77 J | 1.7 J | | 0.74 J |
| Caprolactam | 105-60-2 | mg/kg | | | | | | | | | | | | |
| Carbazole | 86-74-8 | mg/kg | | | | | | | | | | | | |
| Chrysene | 218-01-9 | mg/kg | 1.3 | 0.75 | 1.3 | 1.7 | 0.56 | | 0.9 | 0.96 | 0.51 | 0.575 | | 2.4 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.22 | 0.16 J | 0.25 | 0.37 | 0.1 | | 0.16 | 0.14 | 0.1 | 0.13 U | | 0.47 |
| Dibenzofuran | 132-64-9 | mg/kg | | | | | | | | | | | | |
| Diethylphthalate | 84-66-2 | mg/kg | 0.034 U | 0.084 U | 0.034 U | 0.035 U | 0.038 U | | 0.054 U | 0.073 U | 0.033 U | 0.085 U | | 0.045 U |
| Di-n-butylphthalate | 84-74-2 | mg/kg | 0.039 U | 0.096 U | 0.039 U | 0.04 U | 0.043 U | | 0.062 U | 0.084 U | 0.038 U | 0.098 U | | 0.052 U |
| Di-n-octylphthalate | 117-84-0 | mg/kg | 0.033 U | 0.081 UJ | 0.033 U | 0.034 U | 0.036 UJ | | 0.052 U | 0.07 UJ | 0.032 UJ | 0.082 UJ | | 0.044 U |
| Fluoranthene | 206-44-0 | mg/kg | 2.2 | 1.2 | 2.3 | 3.2 | 0.9 | | 1.8 | 1.6 | 0.86 | 0.72 | | 6 |
| Fluorene | 86-73-7 | mg/kg | 0.083 | 0.051 J | 0.084 | 0.084 | 0.045 J | | 0.084 J | 0.077 J | 0.04 J | 0.059 U | | 0.41 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.95 | 0.58 J | 0.94 | 1.3 | 0.39 | | 0.61 | 0.69 | 0.33 | 0.38 | | 1.4 |
| Naphthalene | 91-20-3 | mg/kg | 0.082 | 0.013 U | 0.022 J | 0.027 J | 0.006 U | | 0.025 J | 0.012 U | 0.022 J | 0.039 J | | 0.13 |
| Phenanthrene | 85-01-8 | mg/kg | 0.72 | 0.37 | 0.66 | 1.1 | 0.4 | | 0.81 | 0.63 | 0.39 | 0.305 | | 4.4 |
| Phenol | 108-95-2 | mg/kg | 0.0074 U | 0.018 U | 0.0073 U | 0.0075 U | 0.0082 U | | 0.012 U | 0.016 U | 0.0072 U | 0.018 U | | 0.0098 U |
| Pyrene | 129-00-0 | mg/kg | 1.3 | 0.83 | 1.4 | 2.1 | 0.66 | | 1.3 | 1.3 | 0.75 | 0.775 | | 4 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 11 | 6.5 | 11 | 16 | 4.6 | | 8.4 | 8.6 | 4.6 | 4.69 | | 24 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 1.2 | 0.63 | 1.1 | 1.6 | 0.64 | | 1.3 | 0.98 | 0.63 | 0.6 | | 6.3 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 12 | 7.1 | 12 | 17 | 5.3 | | 9.6 | 9.6 | 5.3 | 5.29 | | 30 |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | R5-03 | R5-04 | R5-05 | R5-06 | R5-08 | R5-09 | R6-01 | R6-02 | R6-03 | R6-04 | R6-04 | R6-05 |
| | | Sample ID | RI-R5-03-SS | RI-R5-04-SS | RI-R5-05-SS | RI-R5-06-SS | P2-R5-08-SS | P2-R5-09-SS | RI-R6-01-SS | RI-R6-02-SS | RI-R6-03-SS | RI-R6-04-SS | RI-R6-80-SS | RI-R6-05-SS |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | FD | N |
| | | Sample Date | 7/25/2014 | 7/28/2014 | 7/30/2014 | 4/30/2015 | 6/9/2016 | 6/28/2016 | 8/5/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 8/4/2014 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | 0.042 J | 0.015 J | 0.026 U | 0.02 J | 0.037 | | 0.026 U | 0.02 J | 0.045 J | 0.048 J | | 0.12 |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | | | | | | | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | | | | | | | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 0.071 J | 0.031 U | 0.058 U | 0.043 U | 0.043 J | | 0.058 U | 0.032 U | 0.061 J | 0.084 J | | 0.15 J |
| Acenaphthene | 83-32-9 | mg/kg | 0.087 | 0.03 | 0.099 | 0.056 | 0.037 | | 0.041 | 0.045 | 0.039 | 0.021 | | 0.068 |
| Acenaphthylene | 208-96-8 | mg/kg | 0.049 | 0.027 | 0.041 | 0.022 | 0.022 | | 0.018 J | 0.022 | 0.025 | 0.025 | | 0.019 |
| Anthracene | 120-12-7 | mg/kg | 0.27 | 0.11 | 0.21 | 0.19 | 0.074 | | 0.13 | 0.11 | 0.085 | 0.076 | | 0.1 |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 1.6 | 0.62 | 1 | 1 | 0.48 | | 0.79 | 0.6 | 0.32 | 0.27 | | 0.37 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 2.2 | 0.94 | 1.6 | 1.5 | 0.48 | | 1 | 0.87 | 0.42 | 0.36 | | 0.53 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 3.2 | 1.5 | 2.1 | 2.1 | 0.71 | | 1.5 | 1.2 | 0.61 | 0.56 | | 0.78 |
| Benzo(e)pyrene | 192-97-2 | mg/kg | 1.9 | 0.91 | 1.3 | 1.2 | 0.42 | | 0.83 | 0.77 | 0.38 | 0.36 | | 0.53 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 1.7 | 0.8 | 1.1 | 1.2 | 0.45 | | 0.78 | 0.69 | 0.34 | 0.295 | | 0.39 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 1.5 | 0.64 | 1 | 1 | 0.37 | | 0.59 | 0.61 | 0.28 | 0.225 | | 0.32 |
| Chrysene | 218-01-9 | mg/kg | 2.8 | 1.2 | 1.9 | 2.1 | 0.75 | | 1.3 | 1.1 | 0.56 | 0.6 | | 0.82 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.22 J | 0.11 J | 0.13 J | 0.17 J | 0.075 | | 0.11 J | 0.1 J | 0.061 | 0.06 | | 0.072 J |
| Dibenzothiophene | 132-65-0 | mg/kg | | | | | | | | | | | | |
| Fluoranthene | 206-44-0 | mg/kg | 3.7 | 1.6 | 2.7 | 2.8 | 0.75 | | 2 | 1.6 | 0.8 | 0.525 | | 0.94 |
| Fluorene | 86-73-7 | mg/kg | 0.1 | 0.044 | 0.097 | 0.072 | 0.066 | | 0.051 | 0.056 | 0.084 | 0.053 | | 0.066 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 1.5 | 0.7 | 0.98 | 1 | 0.34 | | 0.67 | 0.59 | 0.27 | 0.255 | | 0.33 |
| Naphthalene | 91-20-3 | mg/kg | 0.1 U | 0.056 U | 0.11 U | 0.078 U | 0.04 J | | 0.11 U | 0.075 J | 0.062 J | 0.073 J | | 0.1 J |
| Perylene | 198-55-0 | mg/kg | 0.6 | 0.27 | 0.41 | 0.4 | 0.24 | | 0.28 | 0.24 | 0.15 | 0.24 | | 0.13 |
| Phenanthrene | 85-01-8 | mg/kg | 1.3 | 0.6 | 1 | 1.2 | 0.48 | | 0.85 | 0.72 | 0.52 | 0.34 | | 0.62 |
| Pyrene | 129-00-0 | mg/kg | 3.2 | 1.3 | 2.3 | 2.4 | 0.7 | | 1.6 | 1.4 | 0.8 | 0.61 | | 0.98 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 22 | 9.4 | 15 | 15 | 5.1 | | 10 | 8.8 | 4.5 | 3.76 | | 5.5 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 1.8 | 0.81 | 1.4 | 1.5 | 0.72 | | 1.1 | 1 | 0.82 | 0.59 | | 0.97 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 23 | 10 | 16 | 17 | 5.8 | | 11 | 9.8 | 5.3 | 4.35 | | 6.5 |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | | | | | | | | | | | | |
| Acetone | 67-64-1 | mg/kg | | | | | | | | | | | | |
| Chloroform | 67-66-3 | mg/kg | 0.0011 U | 0.0013 U | 0.0011 U | 0.0011 U | | | 0.0011 U | 0.0012 U | 0.0011 U | 0.0014 U | | 0.00097 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
N (Sample type) - Normal sample.
PCBs - Polychlorinated biphenyls.
U - Not detected.

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | R6-06 | R6-06 | R6-07 | R6-18 | R6-21 | R6-22 | R6-23 | R6-30 | R6-30 | R6-31 | R6-32 | R6-33 |
| | | Sample ID | RI-R6-06-SS | RI-R6-100-SS | RI-R6-07-SS | RI-R6-18-SS | RI-R6-21-SS | RI-R6-22-SS | RI-R6-23-SS | P2-R6-30-SS | P2-R6-40-SS | P2-R6-31-SS | P2-R6-32-SS | P2-R6-33-SS |
| | | Sample Type | N | FD | N | N | N | N | N | N | FD | N | N | N |
| | | Sample Date | 8/4/2014 | 8/4/2014 | 7/30/2014 | 4/30/2015 | 4/29/2015 | 4/30/2015 | 4/30/2015 | 6/9/2016 | 6/9/2016 | 6/28/2016 | 6/28/2016 | 6/28/2016 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | | | | 2.1E-05 J | 0.00013 | 3E-05 J | 2.7E-05 J | 4.65E-05 J | | 1.8E-05 | 0.00055 | 3.9E-06 J |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | | | | 0.00012 | 0.00048 | 0.00019 | 0.00015 | 0.00028 | | 0.00011 | 0.0022 | 2.4E-05 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | | | | 1.7E-06 J | 2.1E-05 | 2.5E-06 J | 1.8E-06 J | 4.1E-06 U | | 1.4E-06 U | 8.3E-05 | 9.5E-08 U |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | | | | 4.5E-06 J | 5.8E-05 | 5.7E-06 | 3.6E-06 J | 1.3E-05 U | | 3.4E-06 J | 0.00023 J | 6.9E-07 U |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | | | | 2.7E-06 J | 3.4E-05 | 4E-06 J | 2.8E-06 J | 7.6E-06 U | | 2.2E-06 J | 0.00016 | 4.3E-07 U |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | | | | 4.3E-06 J | 3.2E-05 J | 3.3E-08 U | 3.1E-08 U | 7.6E-06 U | | 2.7E-06 J | 0.00013 J | 5.4E-07 U |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | | | | 5.9E-06 | 5.9E-05 | 7.8E-06 | 6.3E-06 | 1.3E-05 | | 4.6E-06 J | 0.00031 | 9.8E-07 J |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | | | | 1.5E-07 U | 3.2E-06 J | 2.2E-07 J | 2.1E-07 J | 4.3E-07 U | | 6.2E-08 U | 1.3E-05 | 3.6E-08 U |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | | | | 6.8E-06 | 8.6E-05 | 1E-05 | 6.9E-06 | 2.1E-05 | | 5.5E-06 J | 0.00042 | 1.1E-06 U |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | | | | 1.3E-06 J | 1.4E-05 | 1.4E-06 J | 8.2E-07 J | 2.9E-06 U | | 1.5E-06 J | 6.2E-05 | 1.5E-07 U |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | | | | 2.2E-06 J | 2.7E-05 J | 2.5E-06 J | 1.6E-06 J | 6.3E-06 U | | 2E-06 J | 0.00013 | 3.6E-07 U |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | | | | 2.6E-06 J | 3.6E-05 J | 3.1E-06 J | 2.2E-06 J | 6.4E-06 U | | 1.7E-06 J | 0.00015 J | 3E-07 U |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | | | | 2.6E-06 J | 2.6E-05 | 2.8E-06 J | 1.8E-06 J | 5.8E-06 U | | 2.2E-06 J | 0.00013 | 3.7E-07 U |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | | | | 2E-06 J | 8.7E-06 | 2.4E-06 | 1.7E-06 | 2.85E-06 | | 1.5E-06 | 3.5E-05 | 5.8E-07 J |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | | | | 7.2E-07 J | 4.6E-06 | 8.4E-07 J | 4.7E-07 J | 9.9E-07 J | | 5.4E-07 J | 2.1E-05 | 8.8E-08 J |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | | | | 3.9E-05 | 0.00012 J | 6.6E-05 | 5.5E-05 | 9.9E-05 | | 3.4E-05 | 0.0005 J | 1E-05 U |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | | | | 0.0036 | 0.0036 | 0.0072 J | 0.0053 J | 0.0102 J | | 0.0035 | 0.012 J | 0.00063 |
| **Metals** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 7100 | | 13000 | 12000 | 6000 | 12000 | 12000 | 7500 J | | 8200 J | 4300 J | 6300 J |
| Antimony | 7440-36-0 | mg/kg | 0.46 | | 0.42 J | 0.58 | 0.67 J | 0.48 J+ | 0.47 J+ | 0.785 J | | 0.82 | 1.2 | 0.68 |
| Arsenic | 7440-38-2 | mg/kg | 2.9 | | 5.2 | 5.1 | 5.1 J | 4.3 | 3.8 | 4.55 J | | 4.1 J | 4 J | 3.3 J |
| Barium | 7440-39-3 | mg/kg | 66.5 | | 96 | 98 | 88 | 85 | 78 | 69 J | | 83 | 54 | 70 |
| Beryllium | 7440-41-7 | mg/kg | 0.905 | | 1.4 | 1.1 | 0.66 | 1.1 | 0.99 | 0.955 J | | 0.98 J | 0.58 J | 0.9 J |
| Cadmium | 7440-43-9 | mg/kg | 0.56 | | 0.66 | 0.9 | 1.2 J | 0.65 | 0.63 | 0.705 J | | 0.71 | 1.9 | 0.54 |
| Calcium | 7440-70-2 | mg/kg | 2750 | | 1900 | 2900 | 1900 | 3200 | 3500 | 2950 J | | 2300 J | 2000 J | 2500 J |
| Chromium | 7440-47-3 | mg/kg | 24.5 | | 28 | 49 | 24 | 42 | 38 | 34 J | | 36 J | 24 J | 29 J |
| Cobalt | 7440-48-4 | mg/kg | 11 | | 16 J | 25 | 9.8 | 18 | 18 | 14.5 J | | 14 J | 9.6 J | 14 J |
| Copper | 7440-50-8 | mg/kg | 32.5 | | 45 J | 58 | 40 J | 50 | 45 | 44.5 J | | 48 | 56 | 38 |
| Iron | 7439-89-6 | mg/kg | 15000 | | 23000 J | 28000 | 16000 | 27000 | 26000 | 21500 J | | 22000 J | 12000 J | 18000 J |
| Lead | 7439-92-1 | mg/kg | 42.5 | | 47 | 78 | 61 | 59 | 52 | 47.5 J | | 52 | 74 | 43 |
| Magnesium | 7439-95-4 | mg/kg | 2400 | | 2400 | 3700 | 1800 J | 3900 | 3800 | 2850 J | | 2700 J | 2300 J | 2700 J |
| Manganese | 7439-96-5 | mg/kg | 210 | | 360 | 370 | 120 | 260 | 230 | 220 J | | 200 J | 97 J | 170 J |
| Mercury | 7439-97-6 | mg/kg | 0.0945 | | 0.3 | 0.24 | 0.13 | 0.19 | 0.12 | 0.16 J | | 0.18 | 0.26 | 0.1 |
| Nickel | 7440-02-0 | mg/kg | 24 | | 21 | 42 | 28 J | 36 | 33 | 27.5 J | | 29 J | 50 J | 25 J |
| Potassium | 7440-09-7 | mg/kg | 1250 | | 1100 J | 1900 | 650 | 1700 | 1800 | 1045 J | | 1000 J | 570 J | 1000 J |
| Selenium | 7782-49-2 | mg/kg | 0.345 J | | 0.42 J | 0.97 | 0.6 | 0.88 | 0.79 | 2.75 J | | 2.4 J | 1.3 J | 2 J |
| Silver | 7440-22-4 | mg/kg | 0.5 | | 0.28 | 0.29 | 0.46 J | 0.26 | 0.2 | 0.235 J | | 0.28 | 0.79 | 0.29 |
| Sodium | 7440-23-5 | mg/kg | 145 | | 150 J | 370 | 210 | 280 | 300 | 245 J | | 180 J | 150 J | 140 J |
| Thallium | 7440-28-0 | mg/kg | 0.175 | | 0.22 | 0.28 J+ | 0.15 J | 0.25 J+ | 0.22 J+ | 0.18 J | | 0.19 | 0.13 | 0.16 |
| Vanadium | 7440-62-2 | mg/kg | 22 | | 37 J | 42 | 59 J | 40 | 36 | 34 J | | 35 J | 75 J | 28 J |
| Zinc | 7440-66-6 | mg/kg | 140 | | 150 J | 250 | 170 J | 190 | 170 | 175 J | | 180 J | 250 J | 150 J |
| **Other** | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | 620 J | | 160 U | 4900 | 170 U | 740 | 1800 | | | | | |
| PH | PH | ph units | 6.57 | 6.48 | 6.81 | 6.71 | 6.95 | 6.59 | 6.52 | 6.66 | 6.66 | 6.64 | 6.72 | 6.57 |
| Total Organic Carbon | TOC | mg/kg | 36000 | | 26000 | 64000 | 39000 | 52000 | 38000 | 81000 J | | 50000 | 74000 | 42000 |
| Total Organic Carbon | 7440-44-0 | mg/kg | | | | | | | | | | | | |
| **PCBs/Pesticides** | | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 0.0052 | | 0.0013 J | 0.0039 J | 0.0019 J | 0.003 J | 0.0028 J | 0.0055 J | | 0.0046 J | 0.0057 J | 0.003 J |
| 4,4'-DDE | 72-55-9 | mg/kg | 0.00575 | | 0.0019 | 0.007 J | 0.003 J | 0.0056 J | 0.0046 J | 0.01 J | | 0.0083 | 0.0079 J | 0.0031 J |
| 4,4'-DDT | 50-29-3 | mg/kg | 0.0025 J | | 0.00072 J | 0.0014 J | 0.0026 J | 0.001 J | 0.00086 J | 0.0029 J | | 5.7E-05 U | 4.4E-05 U | 0.0011 J |
| Aldrin | 309-00-2 | mg/kg | 0.000575 | | 0.00017 U | 0.00051 J | 0.0002 J | 0.00033 J | 0.00048 J | 0.00073 J+ | | 5.8E-05 U | 4.5E-05 U | 4.1E-05 UJ |
| alpha-BHC | 319-84-6 | mg/kg | 7.4E-05 U | | 0.00015 U | 8.8E-05 U | 7E-05 U | 6.9E-05 U | 7.1E-05 U | 0.00011 UJ | | 0.00016 U | 0.00013 U | 0.00011 UJ |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.0015 U | | 0.00076 U | 0.0014 U | 0.0011 U | 0.0011 U | 0.0011 U | 0.0052 UJ | | 0.0041 U | 0.25 | 0.0029 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.051 | | 0.015 | 0.056 J | 0.26 | 0.061 J | 0.051 J | 0.092 J | | 0.0026 U | 0.002 U | 0.0018 U |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.0013 U | | 0.00066 U | 0.0013 U | 0.001 U | 0.001 U | 0.001 U | 0.076 J | | 0.0041 U | 0.22 | 0.0029 U |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | R6-06 | R6-06 | R6-07 | R6-18 | R6-21 | R6-22 | R6-23 | R6-30 | R6-30 | R6-31 | R6-32 | R6-33 |
| | | Sample ID | RI-R6-06-SS | RI-R6-100-SS | RI-R6-07-SS | RI-R6-18-SS | RI-R6-21-SS | RI-R6-22-SS | RI-R6-23-SS | P2-R6-30-SS | P2-R6-40-SS | P2-R6-31-SS | P2-R6-32-SS | P2-R6-33-SS |
| | | Sample Type | N | FD | N | N | N | N | N | N | FD | N | N | N |
| | | Sample Date | 8/4/2014 | 8/4/2014 | 7/30/2014 | 4/30/2015 | 4/29/2015 | 4/30/2015 | 4/30/2015 | 6/9/2016 | 6/9/2016 | 6/28/2016 | 6/28/2016 | 6/28/2016 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.0335 | | 0.013 | 0.032 J | 0.16 J | 0.028 J | 0.015 J | 0.072 J | | 0.043 | 0.26 | 0.022 |
| beta-BHC | 319-85-7 | mg/kg | 0.00027 U | | 0.00024 U | 0.00014 U | 0.00011 U | 0.00011 U | 0.00011 U | 0.00018 UJ | | 0.00012 U | 9.6E-05 U | 8.7E-05 UJ |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | 0.059 | | 0.022 | 0.059 J | 0.042 J | 0.049 J | 0.051 J | 0.083 J+ | | 0.051 | 0.068 J | 0.022 J |
| Chlordane (Technical) | 12789-03-6 | mg/kg | 0.059 | | 0.022 | 0.059 J | 0.042 J | 0.049 J | 0.051 J | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | | | | | | | | | | | | |
| delta-BHC | 319-86-8 | mg/kg | 0.00046 J | | 0.00018 J | 0.00052 J | 0.002 J | 0.0004 J | 0.0003 J | 0.00077 J | | 0.0002 U | 0.00015 U | 0.00014 UJ |
| Dieldrin | 60-57-1 | mg/kg | 0.002 J | | 0.00051 J | 0.0014 J | 0.0036 J | 0.00083 J | 0.001 J | 0.0021 J | | 5.2E-05 U | 4E-05 U | 0.00041 J |
| Endosulfan I | 959-98-8 | mg/kg | 8.6E-05 U | | 0.00018 U | 0.0001 U | 0.00037 J | 7.9E-05 U | 8.2E-05 U | 0.00013 UJ | | 3.5E-05 U | 2.7E-05 U | 2.5E-05 UJ |
| Endosulfan II | 33213-65-9 | mg/kg | 0.00094 J | | 0.00018 J | 0.00079 J | 0.003 J | 0.00071 J | 0.00035 J | 0.00059 J | | 0.00017 U | 0.003 J | 0.00012 UJ |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | 0.00061 | | 0.00026 J | 0.0011 J | 0.0027 J | 0.00049 J | 0.00025 J | 0.00125 J | | 7E-05 U | 5.4E-05 U | 5E-05 UJ |
| Endrin | 72-20-8 | mg/kg | 0.00215 | | 0.00094 | 0.00036 J | 0.0055 J | 0.0017 J | 0.0012 J | 0.0026 J | | 0.0021 J | 0.01 J | 0.00073 J |
| Endrin aldehyde | 7421-93-4 | mg/kg | 0.00077 | | 0.00018 U | 0.00017 J | 0.00068 J | 8.2E-05 U | 0.0011 J | 0.00014 UJ | | 0.00016 U | 0.00013 U | 0.00011 UJ |
| Endrin ketone | 53494-70-5 | mg/kg | | | | | | | | | | | | |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | 0.00073 U | | 0.00016 U | 0.00011 J | 0.00036 J | 7.4E-05 U | 7.6E-05 U | 0.00075 J+ | | 0.00024 J | 0.0014 J | 8E-05 UJ |
| Heptachlor | 76-44-8 | mg/kg | 0.000655 | | 0.00036 J | 0.00079 J | 0.00048 J | 0.00089 J | 0.00071 J | 0.00015 UJ | | 4.8E-05 U | 3.7E-05 U | 3.4E-05 UJ |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | 0.00064 J | | 0.00027 J | 0.00068 J | 0.0023 J | 0.00044 J | 0.00052 J | 0.00093 J | | 0.00067 J | 0.0035 J | 4.7E-05 UJ |
| Methoxychlor | 72-43-5 | mg/kg | | | | | | | | | | | | |
| PCB, TOTAL | PCB | mg/kg | | | | | | | | | | | | |
| PCB, Total Congeners | TOTCONG | mg/kg | 0.1279 | | 0.038 | 0.19 | 0.96 | 0.19 | 0.15 | 0.236 | | 0.24 | 1.8 | 0.17 |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.0845 | | 0.028 | 0.088 | 0.42 | 0.089 | 0.066 | 0.24 | | 0.043 | 0.73 | 0.022 |
| trans-Chlordane | 5103-74-2 | mg/kg | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | | | | | | | | | | | | |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | 0.1 U | | 0.029 U | 0.067 U | 0.054 U | 0.053 U | 0.054 U | 0.26 UJ | | 0.069 U | 0.053 U | 0.049 U |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | mg/kg | | | | | | | | | | | | |
| 4-Methylphenol | 106-44-5 | mg/kg | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | mg/kg | 0.0215 J | | 0.044 | 0.086 | 0.036 J | 0.031 J | 0.039 J | 0.032 UJ | | 0.035 J | 0.069 | 0.027 J |
| Acenaphthylene | 208-96-8 | mg/kg | 0.053 J | | 0.085 | 0.075 J | 0.026 J | 0.067 J | 0.065 J | 0.11 J | | 0.097 | 0.11 | 0.083 |
| Acetophenone | 98-86-2 | mg/kg | | | | | | | | | | | | |
| Anthracene | 120-12-7 | mg/kg | 0.0725 J | | 0.17 | 0.22 | 0.069 J | 0.11 | 0.15 | 0.17 J | | 0.13 | 0.2 | 0.12 |
| Benzaldehyde | 100-52-7 | mg/kg | | | | | | | | | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.37 | | 0.4 | 1 | 0.21 J | 0.6 | 0.72 | 0.56 J | | 0.58 | 1 | 0.52 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 0.43 | | 0.42 | 1.1 | 0.24 J | 0.73 | 0.79 | 0.76 J | | 0.67 | 1.1 J | 0.58 J |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 0.69 | | 0.55 | 1.7 | 0.37 J | 1.1 | 1.1 | 1.2 J | | 1.1 | 1.7 J | 0.94 J |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.515 | | 0.45 | 1.4 | 0.26 J | 1 | 1.1 | 1.2 J | | 0.84 | 1.1 J | 0.68 J |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.245 | | 0.2 | 0.42 | 0.13 J | 0.32 | 0.42 | 0.43 J | | 0.43 | 0.58 J | 0.3 J |
| Benzoic acid | 65-85-0 | mg/kg | 0.27 U | | 0.077 U | 1.2 J | 0.14 U | 1 J | 1.1 J | 0.7 UJ | | 0.97 J | 0.84 J | 0.75 J |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | 0.615 J | | 0.32 J | 4 | 10 | 1.2 | 1.1 | 1.8 J | | 1.8 | 2.3 | 1.1 |
| Caprolactam | 105-60-2 | mg/kg | | | | | | | | | | | | |
| Carbazole | 86-74-8 | mg/kg | | | | | | | | | | | | |
| Chrysene | 218-01-9 | mg/kg | 0.575 | | 0.54 | 1.3 | 0.34 J | 0.94 | 1.1 | 1 J | | 0.98 | 1.5 | 0.81 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.11 J | | 0.094 | 0.27 | 0.058 J | 0.2 | 0.19 | 0.037 UJ | | 0.16 | 0.25 J | 0.15 J |
| Dibenzofuran | 132-64-9 | mg/kg | | | | | | | | | | | | |
| Diethylphthalate | 84-66-2 | mg/kg | 0.07 U | | 0.02 U | 0.048 J | 0.037 U | 0.037 U | 0.038 U | 0.18 UJ | | 0.048 U | 0.037 U | 0.034 U |
| Di-n-butylphthalate | 84-74-2 | mg/kg | 0.081 U | | 0.023 U | 0.054 U | 0.043 U | 0.042 U | 0.043 U | 0.21 UJ | | 0.055 U | 0.056 J | 0.039 U |
| Di-n-octylphthalate | 117-84-0 | mg/kg | 0.068 U | | 0.02 U | 0.4 J | 0.036 U | 0.036 U | 0.036 U | 0.18 UJ | | 0.046 U | 0.34 J | 0.29 J |
| Fluoranthene | 206-44-0 | mg/kg | 1 | | 0.75 | 2.1 | 0.54 J | 1.4 | 1.8 | 1.7 J | | 1.3 | 2.4 | 1.4 |
| Fluorene | 86-73-7 | mg/kg | 0.035 J | | 0.062 | 0.094 | 0.051 J | 0.052 J | 0.059 J | 0.073 J | | 0.05 J | 0.087 | 0.047 J |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.41 | | 0.36 | 1.1 | 0.18 J | 0.8 | 0.86 | 0.92 J | | 0.65 | 0.91 J | 0.55 J |
| Naphthalene | 91-20-3 | mg/kg | 0.011 U | | 0.051 | 0.039 J | 0.0059 U | 0.0058 U | 0.006 U | 0.029 UJ | | 0.027 J | 0.064 J | 0.018 J |
| Phenanthrene | 85-01-8 | mg/kg | 0.325 | | 0.34 | 0.81 | 0.19 J | 0.4 | 0.61 | 0.53 J | | 0.4 | 0.8 | 0.41 |
| Phenol | 108-95-2 | mg/kg | 0.015 U | | 0.0044 U | 0.01 U | 0.0081 U | 0.008 U | 0.0082 U | 0.04 UJ | | 0.041 J | 0.034 J | 0.0074 U |
| Pyrene | 129-00-0 | mg/kg | 0.66 | | 0.64 | 1.5 | 0.4 J | 0.96 | 1.1 | 1.2 J | | 1.1 | 1.9 | 0.97 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 5.01 | | 4.4 | 12 | 2.7 | 8.1 | 9.2 | 9 | | 7.8 | 12 | 6.9 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 0.507 | | 0.75 | 1.3 | 0.37 | 0.66 | 0.92 | 0.88 | | 0.74 | 1.3 | 0.71 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 5.51 | | 5.2 | 13 | 3.1 | 8.7 | 10 | 9.9 | | 8.5 | 14 | 7.6 |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | R6-06 | R6-06 | R6-07 | R6-18 | R6-21 | R6-22 | R6-23 | R6-30 | R6-30 | R6-31 | R6-32 | R6-33 |
| | | Sample ID | RI-R6-06-SS | RI-R6-100-SS | RI-R6-07-SS | RI-R6-18-SS | RI-R6-21-SS | RI-R6-22-SS | RI-R6-23-SS | P2-R6-30-SS | P2-R6-40-SS | P2-R6-31-SS | P2-R6-32-SS | P2-R6-33-SS |
| | | Sample Type | N | FD | N | N | N | N | N | N | FD | N | N | N |
| | | Sample Date | 8/4/2014 | 8/4/2014 | 7/30/2014 | 4/30/2015 | 4/29/2015 | 4/30/2015 | 4/30/2015 | 6/9/2016 | 6/9/2016 | 6/28/2016 | 6/28/2016 | 6/28/2016 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | 0.028 U | | 0.046 J | 0.02 J | 0.21 | 0.014 U | 0.015 J | 0.027 J | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | | | | | | | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | | | | | | | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 0.063 U | | 0.086 J | 0.041 J | 0.4 | 0.032 U | 0.029 U | 0.044 U | | | | |
| Acenaphthene | 83-32-9 | mg/kg | 0.0425 | | 0.022 | 0.023 | 0.061 | 0.03 | 0.029 | 0.034 | | | | |
| Acenaphthylene | 208-96-8 | mg/kg | 0.0305 | | 0.034 | 0.019 | 0.022 | 0.011 | 0.016 | 0.027 | | | | |
| Anthracene | 120-12-7 | mg/kg | 0.14 | | 0.089 | 0.094 | 0.083 | 0.09 | 0.11 | 0.086 | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.74 | | 0.31 | 0.54 | 0.21 | 0.53 | 0.67 | 0.98 | | | | |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 1.15 | | 0.42 | 0.8 | 0.25 | 0.83 | 1 | 1 | | | | |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 1.7 | | 0.61 | 1.2 | 0.41 | 1.2 | 1.7 | 1.7 | | | | |
| Benzo(e)pyrene | 192-97-2 | mg/kg | 1 | | 0.38 | 0.7 | 0.27 | 0.71 | 0.9 | 1 | | | | |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.93 | | 0.33 | 0.73 | 0.25 | 0.74 | 0.97 | 1.1 | | | | |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.735 | | 0.26 | 0.6 | 0.21 | 0.62 | 0.69 | 0.85 J | | | | |
| Chrysene | 218-01-9 | mg/kg | 1.5 | | 0.53 | 1.2 | 0.51 | 1.2 | 1.6 | 1.6 | | | | |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.115 J | | 0.062 | 0.12 | 0.051 | 0.12 | 0.14 | 0.19 J | | | | |
| Dibenzothiophene | 132-65-0 | mg/kg | | | | | | | | | | | | |
| Fluoranthene | 206-44-0 | mg/kg | 2 | | 0.58 | 1.4 | 0.44 | 1.4 | 1.9 | 1.8 | | | | |
| Fluorene | 86-73-7 | mg/kg | 0.0595 | | 0.05 | 0.041 | 0.1 | 0.041 | 0.05 | 0.05 | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.79 | | 0.29 | 0.61 | 0.19 | 0.64 | 0.84 | 0.87 | | | | |
| Naphthalene | 91-20-3 | mg/kg | 0.12 U | | 0.077 J | 0.05 U | 0.16 | 0.058 U | 0.053 U | 0.081 U | | | | |
| Perylene | 198-55-0 | mg/kg | 0.28 | | 0.45 | 0.25 | 0.35 | 0.24 | 0.32 | 0.38 | | | | |
| Phenanthrene | 85-01-8 | mg/kg | 0.81 | | 0.31 | 0.46 | 0.38 | 0.53 | 0.67 | 0.66 | | | | |
| Pyrene | 129-00-0 | mg/kg | 1.65 | | 0.65 | 1.2 | 0.54 | 1.3 | 1.6 | 1.5 | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 11.3 | | 4 | 8.4 | 3.1 | 8.6 | 11 | 12 | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 1.08 | | 0.58 | 0.64 | 0.81 | 0.7 | 0.88 | 0.86 | | | | |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 12.4 | | 4.6 | 9 | 3.9 | 9.3 | 12 | 12 | | | | |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | | | | | | | | | | | | |
| Acetone | 67-64-1 | mg/kg | | | | | | | | | | | | |
| Chloroform | 67-66-3 | mg/kg | 0.0013 U | | 0.0013 U | 0.0015 U | 0.0012 U | 0.0012 U | 0.0012 U | | | 0.0033 U | 0.0026 U | 0.0024 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
N (Sample type) - Normal sample.
PCBs - Polychlorinated biphenyls.
U - Not detected.

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | SED1.5B | SED1.5C | SED1.5C | SED10A | SED10B | SED10C | SED1A | SED1B | SED1C | SED2.5B | SED2A | SED2B |
| | | Sample ID | SED1.5B00N | SED1.5C00AN | SED1.5C00AR | SED10A00N | SED10B00N | SED10C00N | SED1A00N | SED1B00N | SED1C00N | SED2.5B00N | SED2A00N | SED2B00N |
| | | Sample Type | N | N | FD | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 11/6/2013 | 6/21/2017 | 6/21/2017 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/6/2013 | 11/6/2013 | 11/7/2013 | 11/7/2013 | 11/6/2013 | 11/5/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | | | | | 4.33E-06 J | | | 2.37E-07 J | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | | | | | 2.49E-05 | | | 8.42E-06 | | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | | | | | 5.92E-07 J | | | 8E-08 JN | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | | | | | 5.74E-07 JN | | | 9.02E-08 JN | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | | | | | 4.79E-07 JN | | | 1.58E-07 JN | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | | | | | 1.13E-06 JN | | | 1.05E-07 JN | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | | | | | 1.18E-06 J | | | 2.65E-07 J | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | | | | | 6.05E-08 JN | | | 1.48E-08 U | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | | | | | 1.33E-06 J | | | 2.09E-07 JN | | | | |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | | | | | 1.93E-07 JN | | | 1.77E-08 U | | | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | | | | | 4.8E-07 JN | | | 4.26E-08 JN | | | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | | | | | 5.2E-07 J | | | 7.37E-08 JN | | | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | | | | | 4.8E-07 J | | | 1.56E-08 U | | | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | | | | | 2.88E-07 JN | | | 1.18E-08 U | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | | | | | 5.93E-08 JN | | | 1.31E-08 U | | | | |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | | | | | 9.87E-06 J | | | 5.14E-07 JN | | | | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | | | | | 0.000683 J | | | 0.000343 | | | | |
| **Metals** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 10000 | 5600 | | 6900 | 3300 | 5300 | 11000 | 18000 | 5200 | 6500 | 8300 | 7600 |
| Antimony | 7440-36-0 | mg/kg | 0.48 J- | 0.6 J | | 0.05 J- | 0.2 J- | 0.31 J- | 0.62 J- | 0.29 | 0.39 | 0.39 | 0.53 J- | 0.48 J- |
| Arsenic | 7440-38-2 | mg/kg | 4.1 | 3 | | 2.8 J- | 1.3 J- | 2.1 J- | 4 | 3.9 | 2 | 1.9 | 3.6 | 2.9 |
| Barium | 7440-39-3 | mg/kg | 98 | 52 | | 79 J+ | 38 | 63 | 110 | 140 | 53 | 60 | 86 | 76 |
| Beryllium | 7440-41-7 | mg/kg | 1.3 | 0.75 | | 1.2 | 0.53 | 0.85 | 1.5 | 1.5 | 0.63 | 0.8 | 1.1 | 0.89 |
| Cadmium | 7440-43-9 | mg/kg | 1.4 | 0.77 | | 0.33 | 0.37 | 0.6 | 1 | 0.62 | 0.58 | 0.52 | 0.99 | 0.81 |
| Calcium | 7440-70-2 | mg/kg | 3500 | 1900 | | 1300 J- | 1700 | 2700 | 3600 | 2500 | 1900 | 2300 | 5100 | 2500 |
| Chromium | 7440-47-3 | mg/kg | 47 J+ | 28 J | | 13 J+ | 16 J+ | 24 J+ | 49 J+ | 37 | 24 | 30 | 37 J+ | 38 J+ |
| Cobalt | 7440-48-4 | mg/kg | 20 | 13 | | 13 J | 8.9 | 16 | 21 | 15 | 11 | 12 | 18 | 16 |
| Copper | 7440-50-8 | mg/kg | 53 J+ | 37 J | | 9.8 | 22 | 40 | 65 J+ | 50 | 28 | 33 | 54 J+ | 45 J+ |
| Iron | 7439-89-6 | mg/kg | 27000 | 15000 | | 17000 | 12000 | 17000 | 31000 | 30000 | 14000 | 17000 | 25000 | 22000 |
| Lead | 7439-92-1 | mg/kg | 99 | 43 | | 11 J | 31 | 44 | 73 | 50 | 37 | 44 | 72 | 63 |
| Magnesium | 7439-95-4 | mg/kg | 3600 | 2500 | | 1400 | 1600 | 2500 | 3800 | 3200 | 2600 | 2800 | 3400 | 2600 |
| Manganese | 7439-96-5 | mg/kg | 470 | 130 J | | 480 | 190 J+ | 210 J+ | 460 | 470 | 160 | 210 | 420 | 310 |
| Mercury | 7439-97-6 | mg/kg | 0.17 | 0.1 J | | 0.075 | 0.099 J | 0.1 J | 0.23 | 0.23 | 0.11 | 0.086 | 0.16 | 0.13 |
| Nickel | 7440-02-0 | mg/kg | 38 | 23 | | 16 | 16 | 26 | 39 | 23 | 19 | 22 | 37 | 30 |
| Potassium | 7440-09-7 | mg/kg | 1200 | 1100 | | 560 | 580 | 1000 | 1300 | 1300 | 1000 | 1100 | 1000 | 1000 |
| Selenium | 7782-49-2 | mg/kg | 1.3 | 0.59 J | | 0.3 J | 0.42 J- | 0.76 J- | 1.4 | 1.4 | 0.53 | 0.62 | 1.2 | 0.95 |
| Silver | 7440-22-4 | mg/kg | 0.48 | 0.52 | | 0.061 J | 0.1 | 0.18 | 0.36 | 0.25 | 0.15 | 0.16 | 0.3 | 0.34 |
| Sodium | 7440-23-5 | mg/kg | 120 | 110 | | 100 | 63 | 100 | 160 | 130 | 110 | 120 | 180 | 110 |
| Thallium | 7440-28-0 | mg/kg | 0.22 | 0.15 | | 0.11 J | 0.1 | 0.17 | 0.25 | 0.29 | 0.15 | 0.16 | 0.19 | 0.18 |
| Vanadium | 7440-62-2 | mg/kg | 39 | 27 | | 23 J+ | 14 | 23 | 44 | 38 | 21 | 22 | 32 | 29 |
| Zinc | 7440-66-6 | mg/kg | 250 | 180 | | 46 J+ | 99 J | 160 J | 240 | 150 | 140 | 130 | 190 | 180 |
| **Other** | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | | | | | | | | | | | | |
| PH | PH | ph units | | | | | | | | | | | | |
| Total Organic Carbon | TOC | mg/kg | | | | | | | | | | | | |
| Total Organic Carbon | 7440-44-0 | mg/kg | 37000 | | | 55000 | 24000 | 37000 | 51000 | 23000 | 25000 | 23000 | 48000 | 33000 |
| **PCBs/Pesticides** | | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | | | | | 0.0022 J | | | 0.00076 J | | | | |
| 4,4'-DDE | 72-55-9 | mg/kg | | | | | 0.0038 J | | | 0.0014 | | | | |
| 4,4'-DDT | 50-29-3 | mg/kg | | | | | 0.0017 J | | | 0.00037 J | | | | |
| Aldrin | 309-00-2 | mg/kg | | | | | 0.00035 J | | | 7.4E-05 J | | | | |
| alpha-BHC | 319-84-6 | mg/kg | | | | | 0.00038 U | | | 0.0004 U | | | | |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.0043 U | 0.0036 U | | 0.01 U | 0.0076 U | 0.0078 U | 0.011 U | 0.0081 U | 0.0069 U | 0.0074 U | 0.0054 U | 0.0045 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.15 J | 0.035 J+ | | 0.01 U | 0.035 J | 0.046 J | 0.095 J | 0.05 J | 0.071 J | 0.053 J | 0.15 J | 0.076 J |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.0043 U | 0.032 J+ | | 0.01 U | 0.0076 U | 0.0078 U | 0.011 U | 0.0081 U | 0.0069 U | 0.0074 U | 0.0054 U | 0.0045 U |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | SED1.5B | SED1.5C | SED1.5C | SED10A | SED10B | SED10C | SED1A | SED1B | SED1C | SED2.5B | SED2A | SED2B |
| | | Sample ID | SED1.5B00N | SED1.5C00AN | SED1.5C00AR | SED10A00N | SED10B00N | SED10C00N | SED1A00N | SED1B00N | SED1C00N | SED2.5B00N | SED2A00N | SED2B00N |
| | | Sample Type | N | N | FD | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 11/6/2013 | 6/21/2017 | 6/21/2017 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/6/2013 | 11/6/2013 | 11/7/2013 | 11/7/2013 | 11/6/2013 | 11/5/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.084 J | 0.02 J+ | | 0.0031 J | 0.031 J | 0.031 J | 0.051 J | 0.028 J | 0.038 J | 0.023 J | 0.081 J | 0.033 J |
| beta-BHC | 319-85-7 | mg/kg | | | | | 0.00029 J | | | 0.0004 U | | | | |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | | | | | | | | | | | | |
| Chlordane (Technical) | 12789-03-6 | mg/kg | | | | | | | | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | | | | | 0.0036 J | | | 0.0014 J | | | | |
| delta-BHC | 319-86-8 | mg/kg | | | | | 0.00038 UJ | | | 0.0004 U | | | | |
| Dieldrin | 60-57-1 | mg/kg | | | | | 0.00081 J | | | 0.00026 J | | | | |
| Endosulfan I | 959-98-8 | mg/kg | | | | | 0.00038 U | | | 0.0004 U | | | | |
| Endosulfan II | 33213-65-9 | mg/kg | | | | | 0.00019 J | | | 0.00021 J | | | | |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | | | | | 0.0006 J | | | 0.00017 J | | | | |
| Endrin | 72-20-8 | mg/kg | | | | | 0.0019 J | | | 0.00031 J | | | | |
| Endrin aldehyde | 7421-93-4 | mg/kg | | | | | 0.00016 J | | | 0.0004 U | | | | |
| Endrin ketone | 53494-70-5 | mg/kg | | | | | 0.0015 J | | | 0.00052 | | | | |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | | | | | 0.00028 J | | | 7.7E-05 J | | | | |
| Heptachlor | 76-44-8 | mg/kg | | | | | 0.0005 J | | | 0.00022 J | | | | |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | | | | | 0.00045 J | | | 0.00012 J | | | | |
| Methoxychlor | 72-43-5 | mg/kg | | | | | 0.0057 | | | 0.0017 J | | | | |
| PCB, TOTAL | PCB | mg/kg | | 0.18 | | | | | | | | | 0.294 | |
| PCB, Total Congeners | TOTCONG | mg/kg | | 0.18 | | | | | | | | | 0.294 | |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.23 | 0.087 | | 0.0031 | 0.066 | 0.077 | 0.15 | 0.078 | 0.11 | 0.076 | 0.23 | 0.11 |
| trans-Chlordane | 5103-74-2 | mg/kg | | | | | 0.0056 J | | | 0.0021 | | | | |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | | | | | 0.3 U | | | 0.16 U | | | | |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | | | | | 0.3 U | | | 0.16 U | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | | | 0.011 J | | | 0.021 J | | | | |
| 4-Chloroaniline | 106-47-8 | mg/kg | | | | | 0.3 U | | | 0.16 U | | | | |
| 4-Methylphenol | 106-44-5 | mg/kg | | | | | 0.3 U | | | 0.16 U | | | | |
| Acenaphthene | 83-32-9 | mg/kg | 0.059 J | 0.15 U | | 0.042 U | 0.018 J | 0.024 J | 0.27 U | 0.019 J | 0.22 U | 0.24 U | 0.26 U | 0.11 U |
| Acenaphthylene | 208-96-8 | mg/kg | 0.06 J | 0.15 U | | 0.042 U | 0.061 U | 0.033 J | 0.27 U | 0.031 J | 0.22 U | 0.24 U | 0.062 J | 0.051 J |
| Acetophenone | 98-86-2 | mg/kg | | | | | 0.3 U | | | 0.015 J | | | | |
| Anthracene | 120-12-7 | mg/kg | 0.22 | 0.078 J | | 0.042 U | 0.061 | 0.082 | 0.076 J | 0.069 | 0.082 J | 0.12 J | 0.12 J | 0.097 J |
| Benzaldehyde | 100-52-7 | mg/kg | | | | | 0.25 J | | | 0.15 J | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 1 | 0.4 | | 0.021 J | 0.38 | 0.48 | 0.36 | 0.26 | 0.49 | 0.61 | 0.42 | 0.39 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 1.1 | 0.56 | | 0.028 J | 0.48 | 0.58 | 0.46 | 0.3 | 0.55 | 0.71 | 0.37 | 0.45 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 1.7 | 0.88 | | 0.043 | 0.7 | 0.84 | 0.92 | 0.44 | 0.73 | 1 | 0.82 | 0.64 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 1.2 | 0.52 | | 0.029 J | 0.43 J | 0.49 J | 0.56 | 0.33 | 0.47 | 0.76 | 0.74 | 0.52 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.54 | 0.31 | | 0.042 U | 0.29 | 0.35 | 0.25 J | 0.21 | 0.4 | 0.47 | 0.28 | 0.24 |
| Benzoic acid | 65-85-0 | mg/kg | | | | | | | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | | | | | 1.1 | | | 0.52 | | | | |
| Caprolactam | 105-60-2 | mg/kg | | | | | 1.6 U | | | 0.83 U | | | | |
| Carbazole | 86-74-8 | mg/kg | | | | | 0.058 J | | | 0.023 J | | | | |
| Chrysene | 218-01-9 | mg/kg | 1.5 | 0.65 | | 0.031 J | 0.58 | 0.7 | 0.69 | 0.4 | 0.71 | 0.94 | 0.76 | 0.62 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.21 | 0.13 J | | 0.042 U | 0.11 | 0.14 | 0.13 J | 0.065 | 0.11 J | 0.17 J | 0.17 J | 0.1 J |
| Dibenzofuran | 132-64-9 | mg/kg | | | | | 0.3 U | | | 0.027 J | | | | |
| Diethylphthalate | 84-66-2 | mg/kg | | | | | 0.3 U | | | 0.16 U | | | | |
| Di-n-butylphthalate | 84-74-2 | mg/kg | | | | | 0.3 U | | | 0.16 U | | | | |
| Di-n-octylphthalate | 117-84-0 | mg/kg | | | | | 0.3 U | | | 0.16 U | | | | |
| Fluoranthene | 206-44-0 | mg/kg | 2.8 | 0.96 | | 0.037 J | 0.88 | 1.1 | 0.94 | 0.58 | 1 | 1.4 | 0.99 | 1.1 |
| Fluorene | 86-73-7 | mg/kg | 0.11 J | 0.15 U | | 0.042 U | 0.023 J | 0.026 J | 0.27 U | 0.036 | 0.22 U | 0.24 U | 0.26 U | 0.11 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 1.2 | 0.44 | | 0.022 J | 0.38 | 0.42 | 0.44 | 0.27 | 0.4 | 0.61 | 0.14 J | 0.41 |
| Naphthalene | 91-20-3 | mg/kg | 0.21 U | 0.15 U | | 0.042 U | 0.061 U | 0.013 J | 0.27 U | 0.027 J | 0.22 U | 0.24 U | 0.26 U | 0.11 U |
| Phenanthrene | 85-01-8 | mg/kg | 1 | 0.31 | | 0.042 U | 0.29 | 0.38 | 0.29 | 0.26 | 0.37 | 0.55 | 0.31 | 0.37 |
| Phenol | 108-95-2 | mg/kg | | | | | 0.061 U | | | 0.033 U | | | | |
| Pyrene | 129-00-0 | mg/kg | 1.8 | 0.79 | | 0.036 J | 0.72 | 0.83 | 0.73 | 0.48 | 0.96 | 1.2 | 0.8 | 0.64 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 13 | 5.6 | | 0.25 | 5 | 5.9 | 5.5 | 3.3 | 5.8 | 7.9 | 5.5 | 5.1 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 1.4 | 0.39 | | 0.042 U | 0.39 | 0.56 | 0.37 | 0.44 | 0.45 | 0.67 | 0.49 | 0.52 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 14 | 6 | | 0.25 | 5.3 | 6.5 | 5.8 | 3.8 | 6.3 | 8.5 | 6 | 5.6 |

# Attachment A Table 1
## Analytical Data - Sediment
## Benning Road Facility RI / FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | SED1.5B | SED1.5C | SED1.5C | SED10A | SED10B | SED10C | SED1A | SED1B | SED1C | SED2.5B | SED2A | SED2B |
| | | Sample ID | SED1.5B00N | SED1.5C00AN | SED1.5C00AR | SED10A00N | SED10B00N | SED10C00N | SED1A00N | SED1B00N | SED1C00N | SED2.5B00N | SED2A00N | SED2B00N |
| | | Sample Type | N | N | FD | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 11/6/2013 | 6/21/2017 | 6/21/2017 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/6/2013 | 11/6/2013 | 11/7/2013 | 11/7/2013 | 11/6/2013 | 11/5/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | 0.0216 J | 0.026 J | | | | 0.0169 J | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | 0.0553 | 0.034 | | | | 0.0127 J | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | 0.0499 | 0.033 | | | | 0.0211 | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 0.0441 J | 0.04 J | | | | 0.029 J | | | | | | |
| Acenaphthene | 83-32-9 | mg/kg | 0.0564 | 0.036 | | | | 0.037 | | | | | | |
| Acenaphthylene | 208-96-8 | mg/kg | 0.0253 | 0.028 | | | | 0.0199 | | | | | | |
| Anthracene | 120-12-7 | mg/kg | 0.153 | 0.13 | | | | 0.114 | | | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.83 | 1.2 | | | | 0.648 | | | | | | |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 1.14 | 1.2 | | | | 0.927 | | | | | | |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 1.77 | 1.9 | | | | 1.54 | | | | | | |
| Benzo(e)pyrene | 192-97-2 | mg/kg | 0.939 | 1 | | | | 0.653 | | | | | | |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.98 | 1 | | | | 0.813 | | | | | | |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.846 | 0.92 | | | | 0.586 | | | | | | |
| Chrysene | 218-01-9 | mg/kg | 2.06 | 1.6 | | | | 1.46 | | | | | | |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.133 J | 0.16 J | | | | 0.116 J | | | | | | |
| Dibenzothiophene | 132-65-0 | mg/kg | 0.0708 | 0.05 | | | | 0.0404 | | | | | | |
| Fluoranthene | 206-44-0 | mg/kg | 2.57 | 2.5 | | | | 1.72 | | | | | | |
| Fluorene | 86-73-7 | mg/kg | 0.0979 | 0.072 | | | | 0.0509 | | | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.812 | 0.81 | | | | 0.618 | | | | | | |
| Naphthalene | 91-20-3 | mg/kg | 0.293 U | 0.2 U | | | | 0.193 U | | | | | | |
| Perylene | 198-55-0 | mg/kg | 0.467 | 0.36 | | | | 0.306 | | | | | | |
| Phenanthrene | 85-01-8 | mg/kg | 1.17 | 0.83 | | | | 0.736 | | | | | | |
| Pyrene | 129-00-0 | mg/kg | 2.21 | 2 | | | | 1.43 | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 13.4 | 13 | | | | 9.86 | | | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 1.5 | 1.1 | | | | 0.958 | | | | | | |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 14.9 | 14 | | | | 10.8 | | | | | | |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | | | | | 0.012 U | | | 0.012 U | | | | |
| Acetone | 67-64-1 | mg/kg | | | | | 0.047 U | | | 0.047 U | | | | |
| Chloroform | 67-66-3 | mg/kg | | | | | 0.012 U | | | 0.012 U | | | | |

Notes:

CALC - Calculated value.

CAS - Chemical Abstracts Service.

FD - Field duplicate.

J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.

mg/kg - Milligram per kilogram.

N (Sample type) - Normal sample.

PCBs - Polychlorinated biphenyls.

U - Not detected.

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED2C | SED3.5B | SED3A | SED3B | SED3C | SED3C | SED4.5B | SED4A | SED4B | SED4B | SED4C | SED5.5B |
| | | Sample ID | SED2C00N | SED3.5B00N | SED3A00N | SED3B00N | SED3C00N | SED3C00R | SED4.5B00N | SED4A00N | SED4B00N | SED4B00R | SED4C00N | SED5.5B00N |
| | | Sample Type | N | N | N | N | N | FD | N | N | N | FD | N | N |
| | | Sample Date | 11/6/2013 | 11/12/2013 | 11/7/2013 | 11/8/2013 | 11/7/2013 | 11/7/2013 | 11/8/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | 0.000155 | | | | 6.61E-06 JN | 1.37E-05 JN | | | 3.44E-05 J | 1.1E-05 J | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | 0.000181 | | | | 3.21E-05 J | 5.78E-05 J | | | 0.000149 J | 5.03E-05 J | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | 4.83E-06 JN | | | | 7.05E-07 JN | 1.27E-06 JN | | | 2.74E-06 J | 1.05E-06 J | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | 0.000128 J | | | | 1.32E-06 JN | 2.07E-06 JN | | | 7.26E-06 JN | 2.29E-06 JN | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | 1.28E-05 | | | | 6.63E-07 J | 1.16E-06 J | | | 2.38E-06 J | 9.3E-07 J | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | 3.58E-05 JN | | | | 1.61E-06 JN | 2.05E-06 JN | | | 1.14E-05 JN | 5.05E-06 JN | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | 1.79E-05 | | | | 1.31E-06 JN | 2.8E-06 J | | | 6.81E-06 | 3.06E-06 J | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | 7.98E-07 JN | | | | 7.05E-08 JN | 1.21E-07 JN | | | 2.95E-07 J | 2.12E-07 JN | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | 3.32E-05 J | | | | 1.58E-06 JN | 3.09E-06 J | | | 5.99E-06 | 2.59E-06 J | | |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | 1.71E-05 | | | | 4.5E-07 JN | 7.36E-07 JN | | | 1.95E-06 J | 7.47E-07 JN | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | 1.05E-05 | | | | 4E-07 JN | 1.23E-06 JN | | | 3.91E-06 JN | 7.86E-07 JN | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | 2.66E-05 JN | | | | 6.1E-07 J | 1.19E-06 JN | | | 4.78E-06 | 1.81E-06 JN | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | 2.83E-05 | | | | 9.98E-07 JN | 1.65E-06 JN | | | 5.61E-06 JN | 2.05E-06 JN | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | 9.98E-06 | | | | 4.68E-07 JN | 8.25E-07 JN | | | 6.38E-06 JN | 1.84E-06 JN | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | 2.08E-06 JN | | | | 2.41E-08 U | 3.34E-07 JN | | | 2.71E-06 JN | 7.39E-07 J | | |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | 3.9E-05 | | | | 1.38E-05 | 2.17E-05 | | | 5.08E-05 J | 1.85E-05 J | | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | 0.00318 | | | | 0.000617 J | 0.00142 J | | | 0.006 J | 0.00181 J | | |
| **Metals** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 6200 | 2000 | 14000 | 1900 | 5900 | 5300 | 13000 | 9400 | 4800 | 6000 | 10000 | 11000 |
| Antimony | 7440-36-0 | mg/kg | 0.5 J- | 0.15 J- | 0.2 U | 0.17 | 0.52 | 0.4 | 0.87 | 0.47 J- | 0.15 J- | 0.15 J- | 0.64 J- | 0.56 J- |
| Arsenic | 7440-38-2 | mg/kg | 2.6 | 0.96 J- | 1.8 | 0.79 | 2.3 | 2.6 | 4.1 | 3.6 J- | 2.7 J- | 3 J- | 3.4 J- | 4.2 J- |
| Barium | 7440-39-3 | mg/kg | 61 | 30 | 180 | 29 | 61 | 55 | 120 | 120 | 76 | 98 | 110 | 130 |
| Beryllium | 7440-41-7 | mg/kg | 0.82 | 0.36 | 1.9 | 0.32 | 0.76 | 0.69 | 1.6 | 1.5 | 0.73 | 0.85 | 1.4 | 1.5 |
| Cadmium | 7440-43-9 | mg/kg | 0.92 | 0.36 | 0.59 | 0.24 | 0.55 | 0.5 | 1 | 0.97 | 0.77 | 1.2 | 1.1 | 1.4 |
| Calcium | 7440-70-2 | mg/kg | 2500 | 1100 | 1100 | 7700 J- | 2400 | 2200 | 4300 J- | 8400 | 1300 | 1600 | 3500 | 3300 |
| Chromium | 7440-47-3 | mg/kg | 29 J+ | 11 J+ | 24 | 11 J+ | 25 | 23 | 54 J+ | 45 J+ | 44 J+ | 73 J+ | 45 | 140 |
| Cobalt | 7440-48-4 | mg/kg | 18 | 6.7 | 16 | 4.8 | 13 | 12 | 23 | 23 | 10 | 11 | 19 | 22 |
| Copper | 7440-50-8 | mg/kg | 40 J+ | 17 | 17 | 9.6 | 29 | 28 | 68 | 66 | 27 | 38 | 66 | 65 |
| Iron | 7439-89-6 | mg/kg | 19000 | 8300 | 16000 | 8300 | 16000 | 14000 | 32000 | 29000 | 14000 | 16000 | 27000 | 29000 |
| Lead | 7439-92-1 | mg/kg | 61 | 19 | 16 | 20 | 36 | 33 | 80 | 72 | 100 | 140 | 80 | 90 |
| Magnesium | 7439-95-4 | mg/kg | 2800 | 840 | 2600 | 870 | 2600 | 2300 | 4500 | 3300 | 1300 | 1700 | 3600 | 3100 |
| Manganese | 7439-96-5 | mg/kg | 200 | 120 J+ | 300 | 120 J- | 200 | 190 | 560 J- | 570 J+ | 160 J+ | 170 J+ | 390 | 530 |
| Mercury | 7439-97-6 | mg/kg | 0.15 | 0.067 J | 0.064 | 0.033 | 0.091 | 0.16 | 0.2 | 0.25 J | 0.12 J | 0.25 J | 0.24 | 0.28 |
| Nickel | 7440-02-0 | mg/kg | 29 | 11 | 26 | 8 | 23 | 21 | 40 | 39 | 16 | 20 | 37 | 33 |
| Potassium | 7440-09-7 | mg/kg | 1000 | 410 | 880 | 500 | 1100 | 960 | 1500 | 1200 | 790 | 900 | 1200 | 1200 |
| Selenium | 7782-49-2 | mg/kg | 0.84 | 0.31 J- | 1.2 | 0.23 J | 0.65 | 0.66 | 1.3 | 1.4 J- | 0.58 J- | 0.77 J- | 1.3 J- | 1.4 J- |
| Silver | 7440-22-4 | mg/kg | 0.27 | 0.064 J | 0.097 J | 0.044 J | 0.14 | 0.16 | 0.41 | 0.38 | 0.4 | 0.63 | 0.43 | 1.4 |
| Sodium | 7440-23-5 | mg/kg | 140 | 47 | 65 | 75 | 110 | 110 | 150 | 260 | 54 | 63 | 160 | 140 |
| Thallium | 7440-28-0 | mg/kg | 0.19 | 0.065 J | 0.18 | 0.057 J | 0.18 | 0.15 | 0.28 | 0.25 | 0.15 | 0.19 | 0.25 | 0.27 |
| Vanadium | 7440-62-2 | mg/kg | 27 | 9.6 | 26 | 8.5 J+ | 26 | 30 | 42 J+ | 38 | 23 | 27 | 41 | 43 |
| Zinc | 7440-66-6 | mg/kg | 200 | 68 J | 73 | 60 | 130 | 120 | 280 | 250 J | 140 J | 200 J | 260 J- | 250 J- |
| **Other** | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | | | | | | | | | | | | |
| PH | PH | ph units | | | | | | | | | | | | |
| Total Organic Carbon | TOC | mg/kg | | | | | | | | | | | | |
| Total Organic Carbon | 7440-44-0 | mg/kg | 35000 | 8400 | 46000 | 6300 | 37000 | 43000 | 43000 | 47000 | 17000 | 20000 | 56000 | 58000 |
| **PCBs/Pesticides** | | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 0.0041 J | | | | 0.0023 J | 0.0033 J | | | 0.068 J | 0.036 J | | |
| 4,4'-DDE | 72-55-9 | mg/kg | 0.0065 J | | | | 0.0028 J | 0.0034 J | | | 0.024 J | 0.026 J | | |
| 4,4'-DDT | 50-29-3 | mg/kg | 0.0028 J | | | | 0.0007 J | 0.0048 J | | | 1.5 J | 0.0014 J | | |
| Aldrin | 309-00-2 | mg/kg | 0.00046 J | | | | 0.00037 J | 0.00048 | | | 0.0016 U | 0.00034 J | | |
| alpha-BHC | 319-84-6 | mg/kg | 0.00083 U | | | | 0.00044 U | 0.00045 U | | | 0.0016 U | 0.00024 J | | |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.0042 U | 0.0061 U | 0.0084 U | 0.0057 U | 0.0087 U | 0.0091 U | 0.01 U | 0.011 U | 0.0062 U | 0.006 U | 0.011 U | 0.011 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.13 J | 0.033 J | 0.0084 U | 0.032 J | 0.13 J | 0.11 J | 0.13 J | 0.1 J | 0.21 J | 0.57 J | 0.28 J | 0.011 U |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.0042 U | 0.0061 U | 0.0084 U | 0.0057 U | 0.0087 U | 0.0091 U | 0.01 U | 0.011 U | 0.0062 U | 0.006 U | 0.011 U | 0.011 U |

| | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED2C | SED3.5B | SED3A | SED3B | SED3C | SED3C |
| | | Sample ID | SED2C00N | SED3.5B00N | SED3A00N | SED3B00N | SED3C00N | SED3C00R |
| | | Sample Type | N | N | N | N | N | FD |
| | | Sample Date | 11/6/2013 | 11/12/2013 | 11/7/2013 | 11/8/2013 | 11/7/2013 | 11/7/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.097 J | 0.017 J | 0.0084 U | 0.01 J | 0.059 J | 0.051 J |
| beta-BHC | 319-85-7 | mg/kg | 0.00058 J | | | | 0.00044 U | 0.00045 U |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | | | | | | |
| Chlordane (Technical) | 12789-03-6 | mg/kg | | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | 0.0064 J | | | | 0.0043 J | 0.0055 J |
| delta-BHC | 319-86-8 | mg/kg | 0.00083 U | | | | 0.00044 U | 0.00045 U |
| Dieldrin | 60-57-1 | mg/kg | 0.0015 J | | | | 0.00062 J | 0.00082 J |
| Endosulfan I | 959-98-8 | mg/kg | 0.00083 U | | | | 0.00044 U | 0.00045 U |
| Endosulfan II | 33213-65-9 | mg/kg | 0.0012 | | | | 0.00013 J | 0.00052 J |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | 0.0015 | | | | 0.00022 J | 0.00084 J |
| Endrin | 72-20-8 | mg/kg | 0.0053 | | | | 0.0013 J | 0.0015 J |
| Endrin aldehyde | 7421-93-4 | mg/kg | 0.0006 J | | | | 0.00044 U | 0.00056 |
| Endrin ketone | 53494-70-5 | mg/kg | 0.0024 J | | | | 0.0023 | 0.0023 |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | 0.0002 J | | | | 0.00021 J | 0.00023 J |
| Heptachlor | 76-44-8 | mg/kg | 0.0013 J | | | | 0.0012 | 0.0014 |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | 0.00072 J | | | | 0.00042 J | 0.00047 J |
| Methoxychlor | 72-43-5 | mg/kg | 0.013 J | | | | 0.0078 | 0.0085 |
| PCB, TOTAL | PCB | mg/kg | | | | | | |
| PCB, Total Congeners | TOTCONG | mg/kg | | | | | | |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.23 | 0.05 | 0.0084 U | 0.042 | 0.19 | 0.16 |
| trans-Chlordane | 5103-74-2 | mg/kg | 0.011 | | | | 0.0071 | 0.0083 |
| **Semi-volatile Organic Compounds** | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | 1.3 U | | | | 0.34 U | 0.36 U |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | 1.3 U | | | | 0.34 U | 0.36 U |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 0.27 U | | | | 0.015 J | 0.073 U |
| 4-Chloroaniline | 106-47-8 | mg/kg | 1.3 U | | | | 0.34 U | 0.36 U |
| 4-Methylphenol | 106-44-5 | mg/kg | 1.3 U | | | | 0.071 J | 0.36 U |
| Acenaphthene | 83-32-9 | mg/kg | 0.27 U | 0.0077 J | 0.0067 U | 0.01 J | 0.061 J | 0.034 J |
| Acenaphthylene | 208-96-8 | mg/kg | 0.067 J | 0.016 J | 0.0067 U | 0.023 U | 0.084 | 0.065 J |
| Acetophenone | 98-86-2 | mg/kg | 1.3 U | | | | 0.03 J | 0.36 U |
| Anthracene | 120-12-7 | mg/kg | 0.13 J | 0.02 J | 0.0067 U | 0.016 J | 0.17 | 0.1 |
| Benzaldehyde | 100-52-7 | mg/kg | 1.3 UJ | | | | 0.32 J | 0.32 J |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.59 | 0.11 | 0.0067 U | 0.11 | 0.62 | 0.41 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 0.67 | 0.13 | 0.0067 U | 0.13 | 0.7 | 0.49 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 0.73 | 0.21 | 0.0067 U | 0.21 | 1 | 0.71 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.73 | 0.11 | 0.0067 U | 0.14 | 0.76 | 0.58 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.56 | 0.066 | 0.0067 U | 0.09 | 0.32 | 0.25 |
| Benzoic acid | 65-85-0 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | 1.5 J | | | | 0.84 | 0.64 J |
| Caprolactam | 105-60-2 | mg/kg | 6.8 U | | | | 1.8 U | 1.9 U |
| Carbazole | 86-74-8 | mg/kg | 0.067 J | | | | 0.095 | 0.063 J |
| Chrysene | 218-01-9 | mg/kg | 0.9 | 0.19 | 0.0067 U | 0.19 | 0.93 | 0.65 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.2 J | 0.024 J | 0.0067 U | 0.032 | 0.17 | 0.13 |
| Dibenzofuran | 132-64-9 | mg/kg | 1.3 U | | | | 0.34 U | 0.36 U |
| Diethylphthalate | 84-66-2 | mg/kg | 1.3 U | | | | 0.34 U | 0.36 U |
| Di-n-butylphthalate | 84-74-2 | mg/kg | 1.3 U | | | | 0.34 U | 0.36 U |
| Di-n-octylphthalate | 117-84-0 | mg/kg | 1.3 U | | | | 0.042 J | 0.36 U |
| Fluoranthene | 206-44-0 | mg/kg | 1.3 | 0.27 | 0.0067 U | 0.29 | 1.8 | 1.2 |
| Fluorene | 86-73-7 | mg/kg | 0.27 U | 0.012 J | 0.0067 U | 0.013 J | 0.081 | 0.073 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.58 | 0.088 | 0.0067 U | 0.11 | 0.6 | 0.44 |
| Naphthalene | 91-20-3 | mg/kg | 0.27 U | 0.0049 J | 0.0067 U | 0.023 U | 0.07 U | 0.073 U |
| Phenanthrene | 85-01-8 | mg/kg | 0.38 | 0.092 | 0.0067 U | 0.19 | 0.64 J | 0.36 J |
| Phenol | 108-95-2 | mg/kg | 0.27 U | | | | 0.07 U | 0.073 U |
| Pyrene | 129-00-0 | mg/kg | 1 | 0.19 | 0.0067 U | 0.27 | 0.91 | 0.64 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 7.3 | 1.4 | 0.0067 U | 1.6 | 7.8 | 5.5 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 0.58 | 0.15 | 0.0067 U | 0.23 | 1 | 0.56 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 7.8 | 1.5 | 0.0067 U | 1.8 | 8.8 | 6.1 |

| | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED4.5B | SED4A | SED4B | SED4B | SED4C | SED5.5B |
| | | Sample ID | SED4.5B00N | SED4A00N | SED4B00N | SED4B00R | SED4C00N | SED5.5B00N |
| | | Sample Type | N | N | N | FD | N | N |
| | | Sample Date | 11/8/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.06 J | 0.048 J | 0.097 J | 0.3 J | 0.11 J | 0.16 J |
| beta-BHC | 319-85-7 | mg/kg | | | 0.0011 J | 0.0011 J | | |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | | | | | | |
| Chlordane (Technical) | 12789-03-6 | mg/kg | | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | | | 0.0061 J | 0.0044 J | | |
| delta-BHC | 319-86-8 | mg/kg | | | 0.0016 U | 0.0015 J | | |
| Dieldrin | 60-57-1 | mg/kg | | | 0.0012 J | 0.0019 J | | |
| Endosulfan I | 959-98-8 | mg/kg | | | 0.0016 U | 0.0015 U | | |
| Endosulfan II | 33213-65-9 | mg/kg | | | 0.00099 J | 0.0015 | | |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | | | 0.00079 J | 0.0027 | | |
| Endrin | 72-20-8 | mg/kg | | | 0.0031 J | 0.0044 J | | |
| Endrin aldehyde | 7421-93-4 | mg/kg | | | 0.00083 J | 0.0015 U | | |
| Endrin ketone | 53494-70-5 | mg/kg | | | 0.00091 J | 0.0019 J | | |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | | | 0.0016 U | 0.00051 J | | |
| Heptachlor | 76-44-8 | mg/kg | | | 0.0033 | 0.003 | | |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | | | 0.0015 J | 0.0013 J | | |
| Methoxychlor | 72-43-5 | mg/kg | | | 0.011 J | 0.012 J | | |
| PCB, TOTAL | PCB | mg/kg | | | | | | |
| PCB, Total Congeners | TOTCONG | mg/kg | | | | | | |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.19 | 0.15 | 0.31 | 0.87 | 0.39 | 0.16 |
| trans-Chlordane | 5103-74-2 | mg/kg | | | 0.01 | 0.008 | | |
| **Semi-volatile Organic Compounds** | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | | | 0.12 U | 0.018 J | | |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | | | 0.12 U | 0.027 J | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | 0.041 | 0.082 | | |
| 4-Chloroaniline | 106-47-8 | mg/kg | | | 0.12 U | 0.12 U | | |
| 4-Methylphenol | 106-44-5 | mg/kg | | | 0.015 J | 0.027 J | | |
| Acenaphthene | 83-32-9 | mg/kg | 0.028 J | 0.034 J | 0.049 J | 0.19 J | 0.022 J | 0.033 J |
| Acenaphthylene | 208-96-8 | mg/kg | 0.081 U | 0.073 J | 0.09 | 0.12 | 0.08 J | 0.085 |
| Acetophenone | 98-86-2 | mg/kg | | | 0.12 U | 0.12 U | | |
| Anthracene | 120-12-7 | mg/kg | 0.095 | 0.1 | 0.096 J | 0.35 J | 0.087 J | 0.11 |
| Benzaldehyde | 100-52-7 | mg/kg | | | R | R | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.5 | 0.41 | 0.35 J | 1 J | 0.47 | 0.41 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 0.58 | 0.53 | 0.34 J | 0.93 J | 0.55 | 0.51 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 0.95 | 0.87 | 0.4 J | 0.91 J | 0.94 | 0.78 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.68 | 0.74 | 0.29 J | 0.74 J | 0.74 | 0.63 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.38 | 0.3 | 0.15 J | 0.49 J | 0.32 | 0.29 |
| Benzoic acid | 65-85-0 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | | | 0.19 J | 0.21 J | | |
| Caprolactam | 105-60-2 | mg/kg | | | 0.63 U | 0.61 U | | |
| Carbazole | 86-74-8 | mg/kg | | | 0.029 | 0.11 | | |
| Chrysene | 218-01-9 | mg/kg | 1 | 0.8 | 0.41 J | 1.1 J | 0.83 | 0.8 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.14 | 0.16 | 0.068 | 0.17 | 0.16 | 0.11 |
| Dibenzofuran | 132-64-9 | mg/kg | | | 0.12 U | 0.07 J | | |
| Diethylphthalate | 84-66-2 | mg/kg | | | 0.12 U | 0.12 U | | |
| Di-n-butylphthalate | 84-74-2 | mg/kg | | | 0.12 U | 0.12 U | | |
| Di-n-octylphthalate | 117-84-0 | mg/kg | | | 0.12 U | 0.12 UJ | | |
| Fluoranthene | 206-44-0 | mg/kg | 1.3 | 0.99 | 0.64 J | 2.5 J | 1 | 0.91 |
| Fluorene | 86-73-7 | mg/kg | 0.03 J | 0.035 J | 0.057 J | 0.19 J | 0.039 J | 0.054 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.55 | 0.53 | 0.22 J | 0.6 J | 0.59 | 0.41 |
| Naphthalene | 91-20-3 | mg/kg | 0.081 U | 0.024 J | 0.036 | 0.061 | 0.022 J | 0.036 J |
| Phenanthrene | 85-01-8 | mg/kg | 0.44 | 0.32 | 0.45 J | 1.9 J | 0.32 | 0.4 |
| Phenol | 108-95-2 | mg/kg | | | 0.025 U | 0.024 U | | |
| Pyrene | 129-00-0 | mg/kg | 1.1 | 0.76 | 0.65 J | 1.8 J | 0.84 | 0.87 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 7.2 | 6.1 | 3.5 | 10 | 6.4 | 5.7 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 0.59 | 0.59 | 0.78 | 2.8 | 0.57 | 0.72 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 7.8 | 6.7 | 4.3 | 13 | 7 | 6.4 |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | SED2C | SED3.5B | SED3A | SED3B | SED3C | SED3C | SED4.5B | SED4A | SED4B | SED4B | SED4C | SED5.5B |
| | | Sample ID | SED2C00N | SED3.5B00N | SED3A00N | SED3B00N | SED3C00N | SED3C00R | SED4.5B00N | SED4A00N | SED4B00N | SED4B00R | SED4C00N | SED5.5B00N |
| | | Sample Type | N | N | N | N | N | FD | N | N | N | FD | N | N |
| | | Sample Date | 11/6/2013 | 11/12/2013 | 11/7/2013 | 11/8/2013 | 11/7/2013 | 11/7/2013 | 11/8/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | | | | | | | | 0.0175 J | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | | | | | | | | 0.0179 J | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | | | | | | | | 0.0457 | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | | | | | | 0.0355 J | | | | |
| Acenaphthene | 83-32-9 | mg/kg | | | | | | | | 0.0167 | | | | |
| Acenaphthylene | 208-96-8 | mg/kg | | | | | | | | 0.0214 | | | | |
| Anthracene | 120-12-7 | mg/kg | | | | | | | | 0.0663 | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | | | | | | | | 0.394 | | | | |
| Benzo(a)pyrene | 50-32-8 | mg/kg | | | | | | | | 0.665 | | | | |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | | | | | | | | 1.23 | | | | |
| Benzo(e)pyrene | 192-97-2 | mg/kg | | | | | | | | 0.624 | | | | |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | | | | | | | | 0.704 | | | | |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | | | | | | | | 0.47 | | | | |
| Chrysene | 218-01-9 | mg/kg | | | | | | | | 1.08 | | | | |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | | | | | | | | 0.0984 J | | | | |
| Dibenzothiophene | 132-65-0 | mg/kg | | | | | | | | 0.029 | | | | |
| Fluoranthene | 206-44-0 | mg/kg | | | | | | | | 1.13 | | | | |
| Fluorene | 86-73-7 | mg/kg | | | | | | | | 0.0371 | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | | | | | | | | 0.527 | | | | |
| Naphthalene | 91-20-3 | mg/kg | | | | | | | | 0.193 U | | | | |
| Perylene | 198-55-0 | mg/kg | | | | | | | | 0.288 | | | | |
| Phenanthrene | 85-01-8 | mg/kg | | | | | | | | 0.412 | | | | |
| Pyrene | 129-00-0 | mg/kg | | | | | | | | 0.988 | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | | | | | | | | 7.29 | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | | | | | | | | 0.554 | | | | |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | | | | | | | | 7.84 | | | | |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | 0.012 | | | | 0.017 U | 0.01 U | | | 0.0074 U | 0.0068 U | | |
| Acetone | 67-64-1 | mg/kg | 0.055 | | | | 0.067 U | 0.041 U | | | 0.03 U | 0.027 U | | |
| Chloroform | 67-66-3 | mg/kg | 0.0082 U | | | | 0.017 U | 0.01 U | | | 0.0074 U | 0.0068 U | | |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
N (Sample type) - Normal sample.
PCBs - Polychlorinated biphenyls.
U - Not detected.

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | SED5A | SED5B | SED5B | SED5C | SED6.5D | SED6.5D | SED6.5E | SED6.5E | SED6A | SED6A | SED6B | SED6B |
| | | Sample ID | SED5A00N | SED5B00AN | SED5B00N | SED5C00N | SED6.5D00EN | SED6.5D00N | SED6.5E00EN | SED6.5E00N | SED6A00EN | SED6A00N | SED6B00EN | SED6B00N |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 11/8/2013 | 6/20/2017 | 11/8/2013 | 11/11/2013 | 6/9/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 6/8/2017 | 11/13/2013 | 6/8/2017 | 11/13/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | | | | | 2.33E-05 | | 6.58E-05 | 0.000307 | 6.56E-06 | | 4.79E-06 | 1.63E-05 JN |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | | | | | 9.74E-05 | | 0.000237 | 0.00108 | 4.35E-05 | | 3.82E-05 | 4.72E-05 J |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | | | | | 2.16E-06 | | 7.66E-06 | 4.16E-05 | 5.35E-07 J | | 3.7E-07 J | 8.09E-07 J |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | | | | | 4.9E-06 | | 1.62E-05 | 0.000158 JN | 4.27E-07 JN | | 4.16E-07 JN | 1.57E-06 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | | | | | 4.59E-06 | | 1.48E-05 | 8.35E-05 | 6.24E-07 J | | 5.17E-07 J | 8.61E-07 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | | | | | 5.37E-06 | | 1.74E-05 | 8.54E-05 | 6.07E-07 J | | 5.02E-07 J | 1.93E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | | | | | 8.94E-06 | | 2.69E-05 | 0.000131 | 1.52E-06 J | | 1.19E-06 J | 2.08E-06 JN |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | | | | | 3.85E-07 JN | | 2.53E-06 J | 6.56E-06 | 1.09E-07 U | | 1.24E-07 U | 1.09E-07 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | | | | | 7.44E-06 | | 2.35E-05 | 0.000196 | 1.48E-06 J | | 1.1E-06 J | 2.42E-06 JN |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | | | | | 3.13E-06 J | | 1.05E-05 J | 4.59E-05 | 3.16E-07 J | | 1.74E-07 JN | 3.7E-07 JN |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | | | | | 4.43E-06 | | 1.54E-05 | 7.6E-05 | 4.89E-07 J | | 3.25E-07 JN | 8.59E-07 JN |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | | | | | 7.04E-06 | | 2.22E-05 | 8.13E-05 JN | 9.16E-07 J | | 8.08E-07 J | 8.88E-07 JN |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | | | | | 6.82E-06 J | | 2.12E-05 J | 6.65E-05 | 1.2E-06 J | | 1E-06 JN | 9.88E-07 JN |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | | | | | 2.29E-06 | | 7.58E-06 | 2.56E-05 JN | 5.39E-07 J | | 4.12E-07 | 9.6E-07 J |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | | | | | 9.18E-07 | | 3.05E-06 | 1.37E-05 | 1.04E-07 U | | 1.02E-07 J | 2.64E-07 JN |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | | | | | 2.55E-05 | | 8.39E-05 | 0.000289 | 1.68E-05 | | 1.13E-05 | 1.87E-05 J |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | | | | | 0.00107 | | 0.00242 | 0.00861 J | 0.00112 | | 0.000911 | 0.00144 |
| **Metals** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 11000 | 10000 | 15000 | 8000 | 8200 | 13000 | 7000 | 6000 | 8200 | 2000 | 5200 | 5500 |
| Antimony | 7440-36-0 | mg/kg | 0.59 | 1.1 | 0.8 | 0.27 J- | 1.3 | 0.77 J- | 2.8 | 1.4 J- | 0.82 | 0.13 J- | 0.42 | 0.35 J- |
| Arsenic | 7440-38-2 | mg/kg | 3.5 | 6.1 | 4.6 | 5.3 J- | 7 | 14 J- | 6.1 | 5.9 J- | 4.5 | 1.2 J- | 2.8 | 1.8 J- |
| Barium | 7440-39-3 | mg/kg | 97 | 100 | 130 | 87 J+ | 81 | 120 J- | 70 | 79 | 83 | 29 | 54 | 60 |
| Beryllium | 7440-41-7 | mg/kg | 1.3 | 1.4 | 1.7 | 0.89 | 1.1 | 1.8 | 0.89 | 0.73 | 1.1 | 0.37 | 0.78 | 0.77 |
| Cadmium | 7440-43-9 | mg/kg | 0.81 | 0.81 | 1.1 | 1 | 2.5 | 2.8 J- | 2.4 | 3.8 J- | 0.61 | 0.33 | 0.38 | 0.5 |
| Calcium | 7440-70-2 | mg/kg | 3200 J- | 4400 | 4000 J- | 1800 J- | 3600 | 1400 J- | 3000 | 3000 | 3700 | 870 | 2200 | 2100 |
| Chromium | 7440-47-3 | mg/kg | 44 J+ | 45 | 57 J+ | 57 J+ | 40 | 47 J- | 31 | 31 | 34 | 14 | 25 | 25 |
| Cobalt | 7440-48-4 | mg/kg | 18 | 23 | 23 | 12 J | 16 | 17 J- | 16 | 16 | 18 | 5.3 | 10 | 12 |
| Copper | 7440-50-8 | mg/kg | 51 | 65 | 70 | 40 | 74 | 130 | 71 | 96 | 50 | 13 | 30 | 34 |
| Iron | 7439-89-6 | mg/kg | 27000 | 30000 | 33000 | 23000 | 20000 | 17000 | 17000 | 16000 | 23000 | 8200 | 16000 | 18000 |
| Lead | 7439-92-1 | mg/kg | 63 | 54 | 84 | 120 J | 99 | 140 | 160 | 130 | 43 | 51 | 33 | 47 |
| Magnesium | 7439-95-4 | mg/kg | 3700 | 3700 | 4600 | 1800 | 3500 | 1800 | 2900 | 2400 | 3100 | 640 | 2200 | 2200 |
| Manganese | 7439-96-5 | mg/kg | 430 J- | 430 | 560 J- | 300 | 190 | 130 J- | 160 | 150 | 300 | 100 | 200 | 260 |
| Mercury | 7439-97-6 | mg/kg | 0.14 | 0.18 | 0.2 | 0.38 | 0.26 | 0.27 J | 0.23 | 0.23 J | 0.18 | 0.045 J- | 0.095 | 0.095 J- |
| Nickel | 7440-02-0 | mg/kg | 33 | 40 | 41 | 20 | 47 | 91 J- | 47 | 65 J- | 31 | 7.7 | 19 | 22 |
| Potassium | 7440-09-7 | mg/kg | 1300 | 1200 | 1500 | 850 | 1000 | 590 | 810 | 610 | 1100 | 380 | 1000 | 950 |
| Selenium | 7782-49-2 | mg/kg | 1.1 | 1.2 | 1.4 | 0.56 | 0.97 | 1.5 J- | 0.86 | 0.78 J- | 1 | 0.33 J- | 0.57 | 0.7 J- |
| Silver | 7440-22-4 | mg/kg | 0.32 | 0.24 | 0.43 | 0.9 | 0.99 | 0.8 | 0.63 | 1.5 J- | 0.35 | 0.12 | 0.12 | 0.17 |
| Sodium | 7440-23-5 | mg/kg | 120 | 240 | 170 | 71 | 220 | 140 | 190 | 140 | 220 | 25 | 120 | 80 |
| Thallium | 7440-28-0 | mg/kg | 0.23 | 0.21 | 0.28 | 0.27 | 0.22 | 0.53 | 0.18 | 0.16 J- | 0.18 | 0.07 | 0.12 | 0.13 |
| Vanadium | 7440-62-2 | mg/kg | 36 J+ | 44 | 49 J+ | 61 J+ | 63 | 250 J+ | 77 | 120 | 33 | 11 | 21 | 20 |
| Zinc | 7440-66-6 | mg/kg | 220 | 280 | 290 | 160 J+ | 340 | 300 J- | 340 | 420 | 200 | 57 J- | 120 | 140 J- |
| **Other** | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | | | | | | | | | | | | |
| PH | PH | ph units | | | | | | | | | | | | |
| Total Organic Carbon | TOC | mg/kg | | | | | | | | | | | | |
| Total Organic Carbon | 7440-44-0 | mg/kg | 35000 | | 39000 | 31000 | 65000 J | 50000 | 70000 | 86000 J | 83000 | 11000 | 21000 | 20000 |
| **PCBs/Pesticides** | | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | | | | | 0.0044 J | | 0.004 J | 0.0024 J | 0.0033 J | | 0.0018 J | 0.0037 |
| 4,4'-DDE | 72-55-9 | mg/kg | | | | | 0.0058 J | | 0.0061 J | 0.0035 J | 0.0065 | | 0.0039 | 0.0043 |
| 4,4'-DDT | 50-29-3 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0019 J | 0.0012 U | | 0.00082 U | 0.0037 J |
| Aldrin | 309-00-2 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.00025 J | 0.0012 U | | 0.00082 U | 0.00072 |
| alpha-BHC | 319-84-6 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.00076 U | 0.0012 U | | 0.00082 U | 0.00072 U |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.009 U | 0.0057 U | 0.011 U | 0.0093 U | 0.0047 U | 0.008 U | 0.0051 U | 0.0076 U | 0.006 U | 0.0055 U | 0.0041 U | 0.0072 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.082 J | 0.077 J+ | 0.13 J | 0.51 J | 0.0047 U | 0.77 J | 0.056 J+ | 0.24 J | 0.029 J+ | 0.11 J | 0.049 J+ | 0.063 J |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.009 U | 0.061 J+ | 0.011 U | 0.0093 U | 0.081 J+ | 0.008 U | 0.082 J+ | 0.0076 UJ | 0.023 J+ | 0.0055 U | 0.052 J+ | 0.0072 U |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED5A | SED5B | SED5B | SED5C | SED6.5D | SED6.5D | SED6.5E | SED6.5E | SED6A | SED6A | SED6B | SED6B |
| | | Sample ID | SED5A00N | SED5B00AN | SED5B00N | SED5C00N | SED6.5D00EN | SED6.5D00N | SED6.5E00EN | SED6.5E00N | SED6A00EN | SED6A00N | SED6B00EN | SED6B00N |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 11/8/2013 | 6/20/2017 | 11/8/2013 | 11/11/2013 | 6/9/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 6/8/2017 | 11/13/2013 | 6/8/2017 | 11/13/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.043 J | 0.043 J+ | 0.095 J | 0.24 J | 0.081 J+ | 1 J | 0.11 J+ | 0.16 J | 0.017 J+ | 0.033 J | 0.027 J+ | 0.059 J |
| beta-BHC | 319-85-7 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.00094 J | 0.0012 U | | 0.00082 U | 0.00072 U |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | | | | | | | | | | | | |
| Chlordane (Technical) | 12789-03-6 | mg/kg | | | | | | | | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | | | | | 0.0078 | | 0.0086 | 0.0058 | 0.013 | | 0.0066 | 0.0051 J |
| delta-BHC | 319-86-8 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0017 J | 0.0012 U | | 0.00082 U | 0.00027 J |
| Dieldrin | 60-57-1 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0013 J | 0.0026 J | | 0.0013 J | 0.0014 J |
| Endosulfan I | 959-98-8 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.00076 U | 0.0012 U | | 0.00082 U | 0.00072 U |
| Endosulfan II | 33213-65-9 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0015 J | 0.0012 U | | 0.00082 U | 0.00023 J |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0029 | 0.0012 U | | 0.00082 U | 0.00093 |
| Endrin | 72-20-8 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0055 J | 0.00068 J | | 0.00082 U | 0.0013 J |
| Endrin aldehyde | 7421-93-4 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.00049 J | 0.0012 U | | 0.00082 U | 0.00023 J |
| Endrin ketone | 53494-70-5 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0027 J | 0.0012 U | | 0.00082 U | 0.0023 J |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0004 J | 0.0012 U | | 0.00082 U | 0.0011 |
| Heptachlor | 76-44-8 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.0008 J | 0.00021 J | | 0.00082 U | 0.00067 J |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | | | | | 0.0012 J | | 0.0023 J | 0.0021 J | 0.00044 J | | 0.00035 J | 0.00055 J |
| Methoxychlor | 72-43-5 | mg/kg | | | | | 0.00093 U | | 0.001 U | 0.007 J | 0.0012 U | | 0.00082 U | 0.012 J |
| PCB, TOTAL | PCB | mg/kg | | 0.24 | | | | | 0.76 | | 0.18 | | 0.21 | |
| PCB, Total Congeners | TOTCONG | mg/kg | | 0.24 | | | | | | 0.76 | 0.18 | | 0.21 | |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.13 | 0.18 | 0.23 | 0.75 | 0.16 | 1.8 | 0.25 | 0.4 | 0.069 | 0.14 | 0.13 | 0.12 |
| trans-Chlordane | 5103-74-2 | mg/kg | | | | | 0.0082 | | 0.001 U | 0.0077 | 0.011 | | 0.006 | 0.0078 |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | | | | | | | | 0.3 U | | | | 0.29 U |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | | | | | | | | 0.3 U | | | | 0.29 U |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | | | | | | 0.074 | | | | 0.019 J |
| 4-Chloroaniline | 106-47-8 | mg/kg | | | | | | | | 0.3 U | | | | 0.29 U |
| 4-Methylphenol | 106-44-5 | mg/kg | | | | | | | | 0.055 J | | | | 0.29 U |
| Acenaphthene | 83-32-9 | mg/kg | 0.031 J | 0.23 U | 0.018 J | 0.08 | | 0.057 J | | 0.061 U | | 0.084 | | 0.035 J |
| Acenaphthylene | 208-96-8 | mg/kg | 0.072 U | 0.23 U | 0.087 U | 0.17 | | 0.035 J | | 0.048 J | | 0.084 | | 0.064 |
| Acetophenone | 98-86-2 | mg/kg | | | | | | | | 0.044 J | | | | 0.29 U |
| Anthracene | 120-12-7 | mg/kg | 0.071 J | 0.23 U | 0.058 J | 0.21 | | 0.06 J | | 0.089 | | 0.13 | | 0.12 |
| Benzaldehyde | 100-52-7 | mg/kg | | | | | | | | 0.064 J | | | | 0.25 J |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.37 | 0.42 | 0.37 | 0.63 | | 0.19 | | 0.4 | | 0.39 | | 0.48 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 0.45 | 0.52 | 0.44 | 0.78 | | 0.19 | | 0.46 | | 0.43 | | 0.61 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 0.73 | 1.1 | 0.8 | 1.1 | | 0.32 | | 0.73 | | 0.47 | | 0.85 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.64 | 0.68 | 0.63 | 0.83 | | 0.19 | | 0.53 | | 0.37 | | 0.62 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.29 | 0.34 | 0.25 | 0.39 | | 0.096 J | | 0.25 | | 0.16 | | 0.31 |
| Benzoic acid | 65-85-0 | mg/kg | | | | | | | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | | | | | | | | 1.3 | | | | 1.1 |
| Caprolactam | 105-60-2 | mg/kg | | | | | | | | 1.6 U | | | | 1.5 U |
| Carbazole | 86-74-8 | mg/kg | | | | | | | | 0.06 J | | | | 0.081 |
| Chrysene | 218-01-9 | mg/kg | 0.75 | 0.88 | 0.72 | 0.96 | | 0.32 | | 0.74 | | 0.47 | | 0.8 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.14 | 0.14 J | 0.096 | 0.17 | | 0.052 J | | 0.14 | | 0.088 | | 0.14 |
| Dibenzofuran | 132-64-9 | mg/kg | | | | | | | | 0.3 U | | | | 0.29 U |
| Diethylphthalate | 84-66-2 | mg/kg | | | | | | | | 0.3 U | | | | 0.29 U |
| Di-n-butylphthalate | 84-74-2 | mg/kg | | | | | | | | 0.041 J | | | | 0.2 J |
| Di-n-octylphthalate | 117-84-0 | mg/kg | | | | | | | | 0.3 U | | | | 0.1 J |
| Fluoranthene | 206-44-0 | mg/kg | 0.84 | 0.92 | 0.8 | 1.1 | | 0.37 | | 1 | | 1 | | 1.4 |
| Fluorene | 86-73-7 | mg/kg | 0.045 J | 0.23 U | 0.041 J | 0.07 J | | 0.063 J | | 0.05 J | | 0.07 | | 0.041 J |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.5 | 0.51 | 0.48 | 0.62 | | 0.14 J | | 0.42 | | 0.29 | | 0.53 |
| Naphthalene | 91-20-3 | mg/kg | 0.072 U | 0.23 U | 0.087 U | 0.075 U | | 0.052 J | | 0.033 J | | 0.018 J | | 0.017 J |
| Phenanthrene | 85-01-8 | mg/kg | 0.3 | 0.45 | 0.26 | 0.56 | | 0.19 | | 0.37 | | 0.61 | | 0.53 |
| Phenol | 108-95-2 | mg/kg | | | | | | | | 0.061 U | | | | 0.058 U |
| Pyrene | 129-00-0 | mg/kg | 0.78 | 1.2 | 0.73 | 1.1 | | 0.41 | | 0.91 | | 0.75 | | 0.9 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 5.5 | 6.7 | 5.3 | 7.7 | | 2.3 | | 5.6 | | 4.4 | | 6.6 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 0.45 | 0.45 | 0.38 | 1.1 | | 0.46 | | 0.59 | | 1 | | 0.81 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 5.9 | 7.2 | 5.7 | 8.8 | | 2.7 | | 6.2 | | 5.4 | | 7.4 |

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED5A | SED5B | SED5B | SED5C | SED6.5D | SED6.5D | SED6.5E | SED6.5E | SED6A | SED6A | SED6B | SED6B |
| | | Sample ID | SED5A00N | SED5B00AN | SED5B00N | SED5C00N | SED6.5D00EN | SED6.5D00N | SED6.5E00EN | SED6.5E00N | SED6A00EN | SED6A00N | SED6B00EN | SED6B00N |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 11/8/2013 | 6/20/2017 | 11/8/2013 | 11/11/2013 | 6/9/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 6/8/2017 | 11/13/2013 | 6/8/2017 | 11/13/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | | 0.041 J | | | 0.05 J | | 0.069 | | 0.02 J | | 0.084 | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | | 0.022 J | | | 0.052 | | 0.096 | | 0.013 J | | 0.015 J | |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | | 0.037 | | | 0.098 | | 0.14 | | 0.022 J | | 0.063 | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | 0.063 J | | | 0.086 J | | 0.13 | | 0.14 U | | 0.13 | |
| Acenaphthene | 83-32-9 | mg/kg | | 0.038 | | | 0.033 | | 0.047 | | 0.026 | | 0.02 | |
| Acenaphthylene | 208-96-8 | mg/kg | | 0.027 | | | 0.019 | | 0.023 | | 0.024 | | 0.021 | |
| Anthracene | 120-12-7 | mg/kg | | 0.094 | | | 0.076 | | 0.093 | | 0.12 | | 0.08 | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | | 1.2 | | | 0.65 | | 0.73 | | 0.91 | | 0.74 | |
| Benzo(a)pyrene | 50-32-8 | mg/kg | | 1.2 | | | 0.67 | | 0.83 | | 0.89 | | 0.85 | |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | | 2.1 | | | 1.1 | | 1.5 | | 1.7 | | 1.3 | |
| Benzo(e)pyrene | 192-97-2 | mg/kg | | 1.2 | | | 0.66 | | 0.78 | | 0.89 | | 0.7 | |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | | 1.4 | | | 0.64 | | 0.81 | | 0.91 | | 0.8 | |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | | 1 | | | 0.51 | | 0.59 | | 0.59 | | 0.6 | |
| Chrysene | 218-01-9 | mg/kg | | 1.9 | | | 1.1 | | 1.3 | | 1.5 | | 1.1 | |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | | 0.23 | | | 0.12 | | 0.15 | | 0.18 | | 0.13 J | |
| Dibenzothiophene | 132-65-0 | mg/kg | | 0.057 | | | 0.055 | | 0.072 | | 0.034 | | 0.03 | |
| Fluoranthene | 206-44-0 | mg/kg | | 2.3 | | | 1.3 | | 1.3 | | 1.7 | | 1.4 | |
| Fluorene | 86-73-7 | mg/kg | | 0.084 | | | 0.066 | | 0.093 | | 0.04 | | 0.039 | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | | 1.1 | | | 0.48 | | 0.63 | | 0.71 | | 0.65 | |
| Naphthalene | 91-20-3 | mg/kg | | 0.072 J | | | 0.066 J | | 0.078 J | | 0.29 U | | 0.19 U | |
| Perylene | 198-55-0 | mg/kg | | 0.4 | | | 0.23 | | 0.29 | | 0.3 | | 0.28 | |
| Phenanthrene | 85-01-8 | mg/kg | | 1 | | | 0.47 | | 0.59 | | 0.57 | | 0.53 | |
| Pyrene | 129-00-0 | mg/kg | | 2 | | | 1 | | 1.2 | | 1.7 | | 1.2 | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | | 14 | | | 7.6 | | 9 | | 11 | | 8.8 | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | | 1.3 | | | 0.73 | | 0.92 | | 0.78 | | 0.69 | |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | | 16 | | | 8.3 | | 10 | | 12 | | 9.5 | |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | | | | | | | | 0.011 U | | | | 0.0089 U |
| Acetone | 67-64-1 | mg/kg | | | | | | | | 0.043 U | | | | 0.036 U |
| Chloroform | 67-66-3 | mg/kg | | | | | | | | 0.011 U | | | | 0.0011 J |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
N (Sample type) - Normal sample.
PCBs - Polychlorinated biphenyls.
U - Not detected.

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED6B | SED6C | SED6C | SED7.5D | SED7.5D | SED7.5E | SED7.5E | SED7A | SED7A | SED7B | SED7B | SED7B |
| | | Sample ID | SED6B00R | SED6C00EN | SED6C00N | SED7.5D00EN | SED7.5D00N | SED7.5E00EN | SED7.5E00N | SED7A00EN | SED7A00N | SED7B00EN | SED7B00N | SED7B00R |
| | | Sample Type | FD | N | N | N | N | N | N | N | N | N | N | FD |
| | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 6/9/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 6/9/2017 | 11/13/2013 | 6/7/2017 | 11/13/2013 | 11/13/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | 2.1E-05 JN | 2.51E-05 | | 9.36E-05 | | 6.67E-05 | | 2.06E-05 | | 3.14E-05 | 3.84E-06 J | 6.8E-06 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | 0.000105 J | 0.000143 | | 0.000382 | | 0.000244 | | 0.000154 | | 6.1E-05 | 2.09E-05 | 3.65E-05 J |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | 1.64E-06 JN | 2.14E-06 JN | | 1.2E-05 | | 7.79E-06 | | 1.44E-06 J | | 1.03E-06 J | 5.35E-07 JN | 7.67E-07 JN |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | 1.67E-06 J | 4.14E-06 | | 1.86E-05 | | 1.21E-05 | | 1.64E-06 J | | 1.46E-06 J | 7.5E-07 JN | 9.2E-07 JN |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | 1.19E-06 JN | 3.63E-06 | | 1.96E-05 | | 1.45E-05 | | 1.99E-06 J | | 7.02E-07 JN | 3.05E-07 JN | 5.35E-07 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | 2.75E-06 JN | 4.63E-06 | | 2.08E-05 | | 1.49E-05 | | 1.49E-06 J | | 2.84E-06 | 1.46E-06 JN | 2.56E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | 3.42E-06 J | 7.98E-06 | | 4E-05 | | 2.64E-05 | | 4.44E-06 | | 2.6E-06 | 8.91E-07 JN | 1.52E-06 JN |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | 1.41E-07 JN | 4.55E-07 JN | | 1E-06 J | | 1.19E-06 J | | 7.65E-08 JN | | 1.29E-07 J | 5.9E-08 J | 8.71E-08 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | 2.53E-06 J | 6.07E-06 | | 3.24E-05 | | 2.11E-05 | | 4.52E-06 | | 1.67E-06 J | 7.83E-07 J | 1.25E-06 J |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | 3.6E-07 JN | 2.09E-06 J | | 1.01E-05 J | | 7.29E-06 J | | 5.68E-07 J | | 6.27E-07 J | 2.33E-07 JN | 2.78E-07 JN |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | 9.97E-07 JN | 3.18E-06 | | 1.84E-05 | | 1.35E-05 | | 1.08E-06 J | | 5.45E-07 J | 4.23E-07 JN | 4.62E-07 JN |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | 9E-07 J | 6.01E-06 | | 2.95E-05 | | 2E-05 | | 2.41E-06 | | 4.15E-06 | 5.09E-07 JN | 8.06E-07 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | 1.01E-06 JN | 8.32E-06 J | | 2.63E-05 J | | 2.01E-05 J | | 2.85E-06 JN | | 8.2E-06 J | 4.9E-07 JN | 5.82E-07 JN |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | 1.22E-06 | 2.23E-06 | | 7.35E-06 | | 5.24E-06 | | 1.1E-06 | | 1.43E-06 | 5.27E-07 JN | 6.19E-07 JN |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | 2.56E-07 JN | 7.43E-07 | | 3.94E-06 | | 2.36E-06 | | 2.86E-07 JN | | 5.97E-07 | 1.94E-08 U | 2.27E-08 U |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | 4.64E-05 JN | 5.52E-05 | | 0.000129 | | 9.57E-05 | | 5.81E-05 | | 3.59E-05 | 7.01E-06 J | 1.62E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | 0.00206 | 0.00379 | | 0.00457 | | 0.00203 | | 0.00444 | | 0.00255 | 0.000628 | 0.000927 |
| **Metals** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 5600 | 13000 | 9800 | 12000 | 13000 | 8900 | 15000 | 12000 | 5900 | 11000 | 8900 | 9300 |
| Antimony | 7440-36-0 | mg/kg | 0.35 J- | 1 | 0.49 J- | 1.7 | 0.43 J- | 2.3 | 1 J- | 1.5 | 0.43 J- | 0.83 | 0.28 J- | 0.23 J- |
| Arsenic | 7440-38-2 | mg/kg | 2 J- | 6.4 | 3.6 J- | 6.8 | 11 J- | 17 | 17 J- | 6.8 | 2.2 J- | 5.5 | 4.2 J- | 3.8 J- |
| Barium | 7440-39-3 | mg/kg | 74 | 110 | 89 | 110 | 97 J- | 110 | 150 J- | 120 | 62 | 120 | 92 | 92 |
| Beryllium | 7440-41-7 | mg/kg | 0.86 | 1.7 | 1.3 | 1.6 | 1.7 | 1.1 | 2.2 | 1.8 | 0.83 | 1.5 | 1.2 | 1.3 |
| Cadmium | 7440-43-9 | mg/kg | 0.54 | 0.99 | 1.2 | 2 | 1.3 J- | 3.3 | 5.2 J- | 0.94 | 0.52 | 0.87 | 1.3 | 1.2 |
| Calcium | 7440-70-2 | mg/kg | 2500 | 4400 | 2800 J- | 4500 | 1400 J- | 5700 | 2500 J- | 6600 | 2500 | 3400 | 1700 | 1600 |
| Chromium | 7440-47-3 | mg/kg | 25 | 51 | 45 | 50 | 80 J- | 62 | 76 J- | 53 | 25 | 60 | 61 | 62 |
| Cobalt | 7440-48-4 | mg/kg | 14 | 22 | 19 | 20 | 15 J- | 23 | 32 J- | 26 | 12 | 18 | 13 | 13 |
| Copper | 7440-50-8 | mg/kg | 35 | 72 | 65 | 94 | 160 | 150 | 240 | 74 | 38 | 55 | 44 | 43 |
| Iron | 7439-89-6 | mg/kg | 18000 | 33000 | 26000 | 29000 | 19000 | 25000 | 25000 | 34000 | 16000 | 28000 | 22000 | 23000 |
| Lead | 7439-92-1 | mg/kg | 40 | 62 | 71 | 97 | 150 | 140 | 230 | 59 | 40 | 85 | 110 | 110 |
| Magnesium | 7439-95-4 | mg/kg | 2300 | 4400 | 2500 | 4400 | 1800 | 5100 | 3100 | 5100 | 2100 | 3200 | 1900 | 1800 |
| Manganese | 7439-96-5 | mg/kg | 300 | 430 | 390 | 250 | 180 J- | 190 | 230 J- | 590 | 270 | 370 | 260 | 270 |
| Mercury | 7439-97-6 | mg/kg | 0.096 J- | 0.24 | 0.23 J+ | 0.3 | 0.28 J | 0.44 | 0.69 J | 0.23 | 0.11 J- | 0.47 | 0.4 J- | 0.34 J- |
| Nickel | 7440-02-0 | mg/kg | 24 | 42 | 36 | 57 | 59 J- | 97 | 150 J- | 45 | 21 | 32 | 22 | 22 |
| Potassium | 7440-09-7 | mg/kg | 950 | 1400 | 1100 | 1300 | 650 | 990 | 760 | 1400 | 710 | 1300 | 950 | 960 |
| Selenium | 7782-49-2 | mg/kg | 0.74 J- | 1.4 | 1.3 J- | 1.2 | 1 J- | 1.4 | 1.8 J- | 1.3 | 0.73 J- | 1.1 | 1.1 J- | 1.1 J- |
| Silver | 7440-22-4 | mg/kg | 0.17 | 0.39 | 0.58 | 0.82 | 0.89 | 1.3 | 3.3 | 0.29 | 0.19 | 0.48 | 1.2 | 1 |
| Sodium | 7440-23-5 | mg/kg | 93 | 250 | 120 J- | 230 | 110 | 270 | 220 | 280 | 110 | 180 | 120 | 86 |
| Thallium | 7440-28-0 | mg/kg | 0.16 | 0.24 | 0.23 J- | 0.26 | 0.35 | 0.27 | 0.63 | 0.24 | 0.13 | 0.23 | 0.27 | 0.27 |
| Vanadium | 7440-62-2 | mg/kg | 22 | 48 | 37 | 88 | 180 J+ | 160 | 360 J+ | 50 | 22 | 42 | 38 | 37 |
| Zinc | 7440-66-6 | mg/kg | 150 J- | 290 | 260 | 410 | 280 J- | 600 | 580 J- | 320 | 140 J- | 230 | 170 J- | 160 J- |
| **Other** | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | | | | | | | | | | | | |
| PH | PH | ph units | | | | | | | | | | | | |
| Total Organic Carbon | TOC | mg/kg | | | | | | | | | | | | |
| Total Organic Carbon | 7440-44-0 | mg/kg | 28000 | 96000 | 44000 | 50000 J | 40000 | 94000 | 140000 | 79000 J | 28000 | 31000 | 21000 | 20000 |
| **PCBs/Pesticides** | | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 0.0049 | 0.0063 J | | 0.0035 J | | 0.0044 J | | 0.0025 J | | 0.0081 J | 0.0089 J | 0.0052 J |
| 4,4'-DDE | 72-55-9 | mg/kg | 0.005 | 0.02 J+ | | 0.0061 J | | 0.01 J | | 0.0056 | | 0.04 | 0.056 | 0.036 |
| 4,4'-DDT | 50-29-3 | mg/kg | 0.0051 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.00071 UJ | 0.0036 J |
| Aldrin | 309-00-2 | mg/kg | 0.001 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.00054 J | 0.0003 J | 0.00018 J |
| alpha-BHC | 319-84-6 | mg/kg | 0.00076 U | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.00071 U | 0.00071 U |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.0076 U | 0.0063 U | 0.011 U | 0.0049 U | 0.0077 U | 0.0059 U | 0.012 U | 0.0062 U | 0.007 U | 0.0055 U | 0.0072 U | 0.0071 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.063 J | 0.078 J+ | 0.13 J | 0.12 J+ | 0.39 J | 0.17 J+ | 0.89 J | 0.0062 U | 0.007 U | 0.066 J+ | 0.34 J | 0.32 J |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.0076 U | 0.11 J+ | 0.011 U | 0.17 J+ | 0.0077 U | 0.25 J+ | 0.012 U | 0.037 J+ | 0.007 U | 0.13 J+ | 0.0072 U | 0.0071 U |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED6B | SED6C | SED6C | SED7.5D | SED7.5D | SED7.5E | SED7.5E | SED7A | SED7A | SED7B | SED7B | SED7B |
| | | Sample ID | SED6B00R | SED6C00EN | SED6C00N | SED7.5D00EN | SED7.5D00N | SED7.5E00EN | SED7.5E00N | SED7A00EN | SED7A00N | SED7B00EN | SED7B00N | SED7B00R |
| | | Sample Type | FD | N | N | N | N | N | N | N | N | N | N | FD |
| | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 6/9/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 6/9/2017 | 11/13/2013 | 6/7/2017 | 11/13/2013 | 11/13/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.027 J | 0.1 J+ | 0.11 J | 0.25 J+ | 0.48 J | 0.36 J+ | 0.97 J | 0.03 J+ | 0.023 | 0.27 J+ | 0.16 J | 0.16 J |
| beta-BHC | 319-85-7 | mg/kg | 0.00076 U | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.0011 J | 0.00074 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | | | | | | | | | | | | |
| Chlordane (Technical) | 12789-03-6 | mg/kg | | | | | | | | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | 0.0087 J | 0.01 J | | 0.0094 | | 0.0096 | | 0.0067 J | | 0.0018 J | 0.0032 J | 0.0012 J |
| delta-BHC | 319-86-8 | mg/kg | 0.00076 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.00025 J | 0.001 J |
| Dieldrin | 60-57-1 | mg/kg | 0.0014 J | 0.0035 J | | 0.00098 U | | 0.0012 U | | 0.0021 J | | 0.0011 U | 0.0032 J | 0.002 J |
| Endosulfan I | 959-98-8 | mg/kg | 0.00064 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.00071 U | 0.00071 U |
| Endosulfan II | 33213-65-9 | mg/kg | 0.00017 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.0013 J | 0.00075 J |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | 0.00044 J | R | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.0036 J | 0.0021 J |
| Endrin | 72-20-8 | mg/kg | 0.0029 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.0085 J | 0.0049 J |
| Endrin aldehyde | 7421-93-4 | mg/kg | 0.00076 U | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.0011 J | 0.0021 J |
| Endrin ketone | 53494-70-5 | mg/kg | 0.0022 J | R | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.00071 U | 0.00071 U |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | 0.00083 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.00071 U | 0.00017 J |
| Heptachlor | 76-44-8 | mg/kg | 0.00072 J | 0.0013 U | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.0048 J | 0.0018 J |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | 0.0014 J | 0.0011 J | | 0.0018 J | | 0.0049 J | | 0.00041 J | | 0.0011 U | 0.0018 J | 0.00089 J |
| Methoxychlor | 72-43-5 | mg/kg | 0.0076 | R | | 0.00098 U | | 0.0012 U | | 0.0012 U | | 0.0011 U | 0.014 J | 0.0093 J |
| PCB, TOTAL | PCB | mg/kg | | | | | | 1.4 | 11.8 | | | | | |
| PCB, Total Congeners | TOTCONG | mg/kg | | | | | | 1.4 | 11.8 | | | | | |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.09 | 0.29 | 0.24 | 0.54 | 0.87 | 0.78 | 1.9 | 0.067 | 0.023 | 0.47 | 0.5 | 0.48 |
| trans-Chlordane | 5103-74-2 | mg/kg | 0.0094 | 0.014 | | 0.0095 | | 0.0012 U | | 0.0094 | | 0.0011 U | 0.0035 J | 0.0031 |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | 0.3 U | | | | | | | | | | 0.14 U | 0.28 U |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | 0.3 U | | | | | | | | | | 0.027 J | 0.28 U |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 0.019 J | | | | | | | | | | 0.029 | 0.03 J |
| 4-Chloroaniline | 106-47-8 | mg/kg | 0.3 U | | | | | | | | | | 0.082 J | 0.28 U |
| 4-Methylphenol | 106-44-5 | mg/kg | 0.3 U | | | | | | | | | | 0.14 U | 0.065 J |
| Acenaphthene | 83-32-9 | mg/kg | 0.032 J | | 0.019 J | | 0.035 J | | 0.059 | | 0.02 J | | 0.034 | 0.034 J |
| Acenaphthylene | 208-96-8 | mg/kg | 0.059 J | | 0.061 J | | 0.028 J | | 0.047 J | | 0.037 J | | 0.072 | 0.086 |
| Acetophenone | 98-86-2 | mg/kg | 0.3 U | | | | | | | | | | 0.14 U | 0.28 U |
| Anthracene | 120-12-7 | mg/kg | 0.12 | | 0.061 J | | 0.047 J | | 0.12 | | 0.066 | | 0.065 | 0.087 |
| Benzaldehyde | 100-52-7 | mg/kg | 0.25 J | | | | | | | | | | 0.024 J | R |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.52 | | 0.42 J | | 0.16 | | 0.36 | | 0.29 | | 0.2 | 0.24 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 0.65 | | 0.53 J | | 0.16 | | 0.31 | | 0.37 | | 0.2 * | 0.24 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 0.91 | | 0.85 J | | 0.29 | | 0.5 | | 0.62 | | 0.23 * | 0.36 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.62 | | 0.35 J | | 0.17 | | 0.29 | | 0.49 | | 0.18 * | 0.24 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.33 | | 0.33 J | | 0.1 | | 0.14 | | 0.19 | | 0.088 * | 0.096 |
| Benzoic acid | 65-85-0 | mg/kg | | | | | | | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | 1.2 | | | | | | | | | | 0.8 | 0.86 |
| Caprolactam | 105-60-2 | mg/kg | 1.6 U | | | | | | | | | | 0.72 U | 1.5 U |
| Carbazole | 86-74-8 | mg/kg | 0.078 | | | | | | | | | | 0.024 J | 0.057 U |
| Chrysene | 218-01-9 | mg/kg | 0.84 | | 0.85 J | | 0.27 | | 0.49 | | 0.55 | | 0.3 | 0.36 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.15 | | 0.089 J | | 0.04 J | | 0.055 | | 0.11 | | 0.031 * | 0.057 U |
| Dibenzofuran | 132-64-9 | mg/kg | 0.3 U | | | | | | | | | | 0.14 U | 0.28 U |
| Diethylphthalate | 84-66-2 | mg/kg | 0.3 U | | | | | | | | | | 0.14 U | 0.28 U |
| Di-n-butylphthalate | 84-74-2 | mg/kg | 0.3 U | | | | | | | | | | 0.024 J | 0.28 U |
| Di-n-octylphthalate | 117-84-0 | mg/kg | 0.043 J | | | | | | | | | | 0.14 U* | 0.28 U |
| Fluoranthene | 206-44-0 | mg/kg | 1.4 | | 1.1 J | | 0.32 | | 0.8 | | 0.85 | | 0.4 | 0.41 |
| Fluorene | 86-73-7 | mg/kg | 0.051 J | | 0.044 J | | 0.044 J | | 0.11 | | 0.031 J | | 0.034 | 0.057 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.55 | | 0.35 J | | 0.12 | | 0.23 | | 0.41 | | 0.13 * | 0.18 |
| Naphthalene | 91-20-3 | mg/kg | 0.017 J | | 0.022 J | | 0.047 J | | 0.094 | | 0.013 J | | 0.019 J | 0.024 J |
| Phenanthrene | 85-01-8 | mg/kg | 0.48 | | 0.3 J | | 0.2 | | 0.47 | | 0.25 | | 0.26 | 0.29 |
| Phenol | 108-95-2 | mg/kg | 0.061 U | | | | | | | | | | 0.029 U | 0.057 U |
| Pyrene | 129-00-0 | mg/kg | 0.89 | | 0.86 J | | 0.34 | | 0.73 | | 0.52 | | 0.42 | 0.5 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 6.9 | | 5.7 | | 2 | | 3.9 | | 4.4 | | 2.2 | 2.6 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 0.76 | | 0.51 | | 0.4 | | 0.9 | | 0.42 | | 0.48 | 0.52 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 7.6 | | 6.2 | | 2.4 | | 4.8 | | 4.8 | | 2.7 | 3.1 |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED6B | SED6C | SED6C | SED7.5D | SED7.5D | SED7.5E | SED7.5E | SED7A | SED7A | SED7B | SED7B | SED7B |
| | | Sample ID | SED6B00R | SED6C00EN | SED6C00N | SED7.5D00EN | SED7.5D00N | SED7.5E00EN | SED7.5E00N | SED7A00EN | SED7A00N | SED7B00EN | SED7B00N | SED7B00R |
| | | Sample Type | FD | N | N | N | N | N | N | N | N | N | N | FD |
| | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 6/9/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 6/9/2017 | 11/13/2013 | 6/7/2017 | 11/13/2013 | 11/13/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | | 0.025 J | | 0.062 | | 0.12 | | 0.026 J | | 0.14 | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | | 0.026 | | 0.076 | | 0.088 | | 0.014 J | | 0.39 | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | | 0.039 | | 0.09 | | 0.18 | | 0.03 | | 0.3 | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | 0.043 J | | 0.09 J | | 0.19 | | 0.15 U | | 0.2 | | |
| Acenaphthene | 83-32-9 | mg/kg | | 0.024 | | 0.036 | | 0.063 | | 0.026 | | 0.09 | | |
| Acenaphthylene | 208-96-8 | mg/kg | | 0.025 | | 0.02 | | 0.03 | | 0.022 | | 0.13 | | |
| Anthracene | 120-12-7 | mg/kg | | 0.064 | | 0.14 | | 0.14 | | 0.069 | | 0.17 | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | | 0.61 | | 0.94 | | 1.1 | | 0.71 | | 0.65 | | |
| Benzo(a)pyrene | 50-32-8 | mg/kg | | 0.72 | | 1 | | 1.3 | | 0.76 | | 0.79 | | |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | | 1.5 | | 1.5 | | 2.2 | | 1.5 | | 1 | | |
| Benzo(e)pyrene | 192-97-2 | mg/kg | | 0.74 | | 1 | | 1.3 | | 0.82 | | 0.64 | | |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | | 0.83 | | 0.96 | | 1.1 | | 0.98 | | 0.7 | | |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | | 0.49 | | 0.67 | | 1.1 | | 0.64 | | 0.51 | | |
| Chrysene | 218-01-9 | mg/kg | | 1.2 | | 1.6 | | 2.1 | | 1.3 | | 0.95 | | |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | | 0.16 | | 0.18 | | 0.21 | | 0.18 | | 0.14 | | |
| Dibenzothiophene | 132-65-0 | mg/kg | | 0.036 | | 0.054 | | 0.09 | | 0.035 | | 0.18 | | |
| Fluoranthene | 206-44-0 | mg/kg | | 1.3 | | 1.5 | | 2.3 | | 1.5 | | 1.1 | | |
| Fluorene | 86-73-7 | mg/kg | | 0.04 | | 0.071 | | 0.13 | | 0.046 | | 0.17 | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | | 0.63 | | 0.73 | | 0.95 | | 0.73 | | 0.51 | | |
| Naphthalene | 91-20-3 | mg/kg | | 0.045 J | | 0.07 J | | 0.12 J | | 0.29 U | | 0.17 | | |
| Perylene | 198-55-0 | mg/kg | | 0.31 | | 0.33 | | 0.42 | | 0.29 | | 0.25 | | |
| Phenanthrene | 85-01-8 | mg/kg | | 0.45 | | 0.95 | | 0.96 | | 0.63 | | 1 | | |
| Pyrene | 129-00-0 | mg/kg | | 1.2 | | 2.7 | | 2.1 | | 1.3 | | 1.3 | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | | 8.6 | | 12 | | 14 | | 9.6 | | 7.7 | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | | 0.65 | | 1.3 | | 1.4 | | 0.79 | | 1.7 | | |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | | 9.3 | | 13 | | 16 | | 10 | | 9.4 | | |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | 0.0083 U | | | | | | | | | | 0.0085 U | 0.0098 U |
| Acetone | 67-64-1 | mg/kg | 0.02 J | | | | | | | | | | 0.034 U | 0.039 U |
| Chloroform | 67-66-3 | mg/kg | 0.0083 U | | | | | | | | | | 0.0012 J | 0.0014 J |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
N (Sample type) - Normal sample.
PCBs - Polychlorinated biphenyls.
U - Not detected.

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED7D | SED7D | SED7E | SED7E | SED7E | SED7F | SED7F | SED7G | SED8.5B | SED8A | SED8A | SED8B |
| | | Sample ID | SED7D00EN | SED7D00N | SED7E00AN | SED7E00EN | SED7E00N | SED7F00EN | SED7F00N | SED7G00N | SED8.5B00N | SED8A00EN | SED8A00N | SED8B00EN |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 6/9/2017 | 11/25/2013 | 6/22/2017 | 6/8/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 1/30/2014 | 11/13/2013 | 6/9/2017 | 11/13/2013 | 6/9/2017 |
| | | Depth Interval | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | 5.1E-05 | | | 6.11E-05 | | 4.92E-05 | 0.00108 | 1.83E-05 JN | | 6.98E-06 | | 1.35E-05 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | 0.000254 | | | 0.000204 | | 0.000166 | 0.0041 J | 4.89E-05 | | 6.17E-05 | | 8.56E-05 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | 5.2E-06 | | | 6.2E-06 | | 5.58E-06 | 0.000151 JN | 1.77E-06 J | | 5.43E-07 J | | 8.59E-07 J |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | 8.71E-06 | | | 1.14E-05 | | 9.35E-06 | 0.00047 JN | 2.39E-06 J | | 7.05E-07 J | | 1.13E-06 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | 9.6E-06 | | | 1.04E-05 | | 1.06E-05 | 0.000289 | 2.47E-06 J | | 7.91E-07 J | | 1.24E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | 1E-05 | | | 1.2E-05 | | 1.05E-05 | 0.000272 JN | 3.65E-06 JN | | 5.87E-07 J | | 1.1E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | 2.01E-05 | | | 2.11E-05 | | 1.9E-05 | 0.000548 | 4.11E-06 J | | 1.87E-06 J | | 2.76E-06 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | 9.61E-07 J | | | 1.95E-06 | | 8.42E-07 JN | 2.43E-05 J | 2.97E-07 U | | 1.86E-07 U | | 5.83E-08 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | 1.65E-05 | | | 1.73E-05 | | 1.51E-05 | 0.000705 J | 6.05E-06 | | 1.65E-06 JN | | 2.68E-06 |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | 4.54E-06 J | | | 6.09E-06 J | | 4.99E-06 J | 0.000124 | 9.72E-07 J | | 2.15E-07 J | | 3.86E-07 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | 8.79E-06 | | | 1.01E-05 | | 9.72E-06 | 0.000277 JN | 6.9E-06 JN | | 5.62E-07 J | | 7.13E-07 J |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | 1.39E-05 | | | 1.89E-05 | | 1.48E-05 | 0.000285 | 3.05E-06 J | | 9.07E-07 JN | | 1.57E-06 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | 1.37E-05 J | | | 2.27E-05 J | | 1.48E-05 J | 0.000217 | 2.18E-06 J | | 1.23E-06 J | | 2.04E-06 J |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | 3.93E-06 | | | 5.06E-06 | | 3.56E-06 | 5.67E-05 | 9E-07 J | | 4.59E-07 J | | 8.26E-07 JN |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | 1.65E-06 | | | 1.93E-06 | | 1.6E-06 | 3.82E-05 | 5.2E-07 U | | 1.31E-07 U | | 2.07E-07 J |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | 8.72E-05 | | | 8.21E-05 | | 6.25E-05 | 0.001 JN | 2.18E-05 | | 1.77E-05 | | 3.11E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | 0.00437 | | | 0.00157 | | 0.00139 | 0.0147 | 0.000341 | | 0.00172 | | 0.00281 |
| **Metals** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 10000 | 7300 | 3700 | 4000 | 4500 | 7500 | 7300 | 2400 | 7700 | 12000 | 9700 | 11000 |
| Antimony | 7440-36-0 | mg/kg | 1.1 | 0.69 J- | 1.4 J | 1.1 | 1.2 J- | 43 | 2.8 J- | 0.38 | 0.45 J- | 1.1 | 0.55 J- | 1 |
| Arsenic | 7440-38-2 | mg/kg | 5.7 | 4.3 J- | 5.6 J | 5.1 | 4.6 J- | 7.2 | 11 J- | 2.5 | 2.6 J- | 5.9 | 2.9 J- | 5.3 |
| Barium | 7440-39-3 | mg/kg | 97 | 110 J- | 54 | 52 | 72 J- | 87 | 100 | 17 | 84 | 120 | 99 | 100 |
| Beryllium | 7440-41-7 | mg/kg | 1.4 | 1 | 0.54 | 0.51 | 0.71 | 1 | 0.95 | 0.15 | 1.1 | 1.7 | 1.4 | 1.5 |
| Cadmium | 7440-43-9 | mg/kg | 1.5 | 4.7 J- | 2.4 J | 1.7 | 3.7 J- | 2.6 | 4.4 J- | 0.74 | 0.73 | 0.86 | 0.87 | 0.69 |
| Calcium | 7440-70-2 | mg/kg | 3700 | 2000 J- | 3500 J | 3300 | 4200 J- | 4000 | 2300 | 17000 | 2800 | 3900 | 3100 | 4600 |
| Chromium | 7440-47-3 | mg/kg | 46 | 36 J- | 19 | 29 | 29 J- | 40 | 46 | 33 | 32 | 49 | 40 | 45 |
| Cobalt | 7440-48-4 | mg/kg | 19 | 16 J- | 4.9 | 9.3 | 13 J- | 14 | 13 | 7.1 | 16 | 20 | 19 | 20 |
| Copper | 7440-50-8 | mg/kg | 73 | 64 | 45 J | 64 | 110 | 130 | 190 | 54 | 45 | 66 | 55 | 58 |
| Iron | 7439-89-6 | mg/kg | 28000 | 17000 | 7500 | 13000 | 14000 | 20000 | 21000 | 12000 | 22000 | 32000 | 25000 | 29000 |
| Lead | 7439-92-1 | mg/kg | 71 | 170 | 120 | 76 | 130 | 130 | 320 | 48 | 55 | 62 | 66 | 55 |
| Magnesium | 7439-95-4 | mg/kg | 4300 | 2700 | 2900 J | 3100 | 3200 | 3900 | 2800 | 12000 | 3000 | 4000 | 3500 | 4100 |
| Manganese | 7439-96-5 | mg/kg | 270 | 180 J- | 86 | 100 | 120 J- | 200 | 200 | 120 | 370 | 420 | 360 | 390 |
| Mercury | 7439-97-6 | mg/kg | 0.29 | 0.24 J | 0.21 J | 0.18 | 0.27 J | 0.36 | 0.46 J | 0.041 | 0.13 J- | 0.21 | 0.2 J- | 0.11 |
| Nickel | 7440-02-0 | mg/kg | 46 | 50 J- | 38 J | 56 | 120 J- | 75 | 160 J- | 84 | 29 | 38 | 34 | 36 |
| Potassium | 7440-09-7 | mg/kg | 1400 | 1100 | 390 | 460 | 450 | 870 | 580 | 230 | 1100 | 1400 | 1300 | 1400 |
| Selenium | 7782-49-2 | mg/kg | 1.1 | 0.72 J- | 0.5 J | 0.61 | 0.54 J- | 0.93 | 1.1 J- | 0.034 J | 0.98 J- | 1.3 | 1.2 J- | 1.1 |
| Silver | 7440-22-4 | mg/kg | 0.45 | 1.3 | 0.7 J | 0.55 | 0.92 | 1.6 | 3.5 J- | 0.083 | 0.24 | 0.33 | 0.31 | 0.25 |
| Sodium | 7440-23-5 | mg/kg | 220 | 100 | 91 J | 140 | 110 | 200 | 160 | 420 | 120 | 220 | 140 | 200 |
| Thallium | 7440-28-0 | mg/kg | 0.24 | 0.25 | 0.14 | 0.13 | 0.15 | 0.2 | 0.13 J- | 0.037 J | 0.19 | 0.26 | 0.24 | 0.23 |
| Vanadium | 7440-62-2 | mg/kg | 56 | 110 J+ | 94 J | 110 | 150 J+ | 140 | 440 | 56 | 28 | 45 | 35 | 41 |
| Zinc | 7440-66-6 | mg/kg | 320 | 380 J- | 180 J | 280 | 430 J- | 470 | 630 | 260 | 190 J- | 260 | 220 J- | 240 |
| **Other** | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | | | | | | | | | | | | |
| PH | PH | ph units | | | | | | | | | | | | |
| Total Organic Carbon | TOC | mg/kg | | | | | | | | | | | | |
| Total Organic Carbon | 7440-44-0 | mg/kg | 58000 J | 49000 | | 45000 | 51000 | 58000 | 240000 J | 8400 | 31000 | 66000 J | 41000 | 67000 J |
| **PCBs/Pesticides** | | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 0.0032 J | | | 0.0035 J | | 0.0034 J | 0.012 J | 0.009 | | 0.0025 J | | 0.0021 J |
| 4,4'-DDE | 72-55-9 | mg/kg | 0.0083 | | | 0.0042 J | | 0.0051 J | 0.0059 J | 0.0013 U | | 0.0061 | | 0.004 |
| 4,4'-DDT | 50-29-3 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.011 J | 0.00091 J | | 0.0011 U | | 0.0018 J |
| Aldrin | 309-00-2 | mg/kg | 0.001 U | | | 0.00013 J | | 0.00096 U | 0.00075 J | 0.0013 U | | 0.0011 U | | 0.0011 U |
| alpha-BHC | 319-84-6 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.0019 U | 0.0013 U | | 0.0011 U | | 0.0011 U |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.0051 U | 0.0074 U | 0.0029 U | 0.0037 U | 0.0072 U | 0.0048 U | 0.0075 U | 0.005 U | 0.0088 U | 0.0057 U | 0.0096 U | 0.0055 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.0051 U | 0.4 J | 0.2 J+ | 0.17 J+ | 0.55 J | 0.067 J+ | 0.39 J | 0.1 J | 0.076 J | 0.0057 U | 0.11 J | 0.0055 U |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.029 J+ | 0.0074 U | 0.24 J | 0.17 J+ | 0.0072 UJ | 0.1 J+ | 0.0075 U | 0.005 U | 0.0088 U | 0.032 J+ | 0.0096 U | 0.019 J+ |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED7D | SED7D | SED7E | SED7E | SED7E | SED7F | SED7F | SED7G | SED8.5B | SED8A | SED8A | SED8B |
| | | Sample ID | SED7D00EN | SED7D00N | SED7E00AN | SED7E00EN | SED7E00N | SED7F00EN | SED7F00N | SED7G00N | SED8.5B00N | SED8A00EN | SED8A00N | SED8B00EN |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 6/9/2017 | 11/25/2013 | 6/22/2017 | 6/8/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 1/30/2014 | 11/13/2013 | 6/9/2017 | 11/13/2013 | 6/9/2017 |
| | | Depth Interval | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.024 J+ | 0.22 J | 0.35 J+ | 0.29 J+ | 0.41 J | 0.13 J+ | 0.38 J | 0.13 J | 0.035 J | 0.027 J+ | 0.046 J | 0.014 J+ |
| beta-BHC | 319-85-7 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.002 J | 0.0013 U | | 0.0011 U | | 0.0011 U |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | | | | | | | | | | | | |
| Chlordane (Technical) | 12789-03-6 | mg/kg | | | | | | | | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | 0.0099 | | | 0.0077 | | 0.008 | 0.01 | 0.0017 J | | 0.0067 J | | 0.0048 J |
| delta-BHC | 319-86-8 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.0055 J | 0.0024 J | | 0.0011 U | | 0.0011 U |
| Dieldrin | 60-57-1 | mg/kg | 0.002 J | | | 0.00073 U | | 0.00096 U | 0.0049 J | 0.0023 J | | 0.002 J | | 0.0015 J |
| Endosulfan I | 959-98-8 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.0012 J | 0.0015 J | | 0.0011 U | | 0.0011 U |
| Endosulfan II | 33213-65-9 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.005 J | 0.0013 U | | 0.0011 U | | 0.0011 U |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.01 | 0.0036 | | 0.0011 U | | 0.0011 U |
| Endrin | 72-20-8 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.022 J | 0.0023 J | | 0.0011 U | | 0.00049 J |
| Endrin aldehyde | 7421-93-4 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.0014 J | 0.001 J | | 0.0011 U | | 0.0011 U |
| Endrin ketone | 53494-70-5 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.008 J | 0.0013 U | | 0.0011 U | | 0.0011 U |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.00077 J | 0.0016 J | | 0.0011 U | | 0.0011 U |
| Heptachlor | 76-44-8 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.001 J | 0.00065 J | | 0.0011 U | | 0.0011 U |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | 0.0012 J | | | 0.0041 J | | 0.0022 J | 0.0062 J | 0.00062 J | | 0.0008 J | | 0.00039 J |
| Methoxychlor | 72-43-5 | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U | 0.023 J | 0.019 J | | 0.0011 U | | 0.0011 U |
| PCB, TOTAL | PCB | mg/kg | | | | 0.98 | | 1 | | | | | | |
| PCB, Total Congeners | TOTCONG | mg/kg | | | | 0.98 | | 1 | | | | | | |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.053 | 0.62 | 0.79 | 0.63 | 0.96 | 0.3 | 0.77 | 0.23 | 0.11 | 0.059 | 0.16 | 0.033 |
| trans-Chlordane | 5103-74-2 | mg/kg | 0.0093 | | | 0.00073 U | | 0.00096 U | 0.0082 J | 0.0019 | | 0.0089 | | 0.0063 |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | | | | | | | 0.3 U | 0.2 U | | | | |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | | | | | | | 0.3 U | 0.2 U | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | | | | | 0.067 | 0.068 | | | | |
| 4-Chloroaniline | 106-47-8 | mg/kg | | | | | | | 0.3 U | 0.2 U | | | | |
| 4-Methylphenol | 106-44-5 | mg/kg | | | | | | | 0.3 U | 0.11 J | | | | |
| Acenaphthene | 83-32-9 | mg/kg | | 0.035 J | 0.1 | | 0.046 J | | 0.064 | 0.14 | 0.032 J | | 0.029 J | |
| Acenaphthylene | 208-96-8 | mg/kg | | 0.07 J | 0.017 J | | 0.027 J | | 0.043 J | 0.023 J | 0.052 J | | 0.068 J | |
| Acetophenone | 98-86-2 | mg/kg | | | | | | | 0.03 J | 0.027 J | | | | |
| Anthracene | 120-12-7 | mg/kg | | 0.11 J | 0.2 | | 0.13 J | | 0.14 | 0.21 | 0.094 | | 0.11 | |
| Benzaldehyde | 100-52-7 | mg/kg | | | | | | | 0.3 UJ | 0.19 J | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | | 0.48 | 0.55 | | 0.49 | | 0.59 | 0.95 | 0.48 | | 0.53 | |
| Benzo(a)pyrene | 50-32-8 | mg/kg | | 0.54 | 0.44 | | 0.52 | | 0.6 | 0.89 | 0.5 | | 0.71 | |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | | 0.86 | 0.65 | | 0.85 | | 0.86 | 1.2 | 0.8 | | 1.1 | |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | | 0.47 | 0.31 | | 0.47 | | 0.64 | 0.78 | 0.65 | | 0.87 | |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | | 0.19 | 0.22 | | 0.27 | | 0.3 | 0.43 | 0.41 | | 0.33 | |
| Benzoic acid | 65-85-0 | mg/kg | | | | | | | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | | | | | | | 0.59 J | 0.55 | | | | |
| Caprolactam | 105-60-2 | mg/kg | | | | | | | 1.5 U | 1 U | | | | |
| Carbazole | 86-74-8 | mg/kg | | | | | | | 0.1 | 0.25 | | | | |
| Chrysene | 218-01-9 | mg/kg | | 0.63 | 0.62 | | 0.76 | | 0.89 | 1.2 | 0.82 | | 1 | |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | | 0.086 J | 0.084 | | 0.094 J | | 0.16 | 0.15 | 0.13 | | 0.17 | |
| Dibenzofuran | 132-64-9 | mg/kg | | | | | | | 0.042 J | 0.11 J | | | | |
| Diethylphthalate | 84-66-2 | mg/kg | | | | | | | 0.3 U | 0.2 U | | | | |
| Di-n-butylphthalate | 84-74-2 | mg/kg | | | | | | | 0.3 U | 0.2 U | | | | |
| Di-n-octylphthalate | 117-84-0 | mg/kg | | | | | | | 0.3 U | 0.15 J | | | | |
| Fluoranthene | 206-44-0 | mg/kg | | 0.87 | 0.9 | | 1.2 | | 1.3 | 2.6 | 0.95 | | 1.3 | |
| Fluorene | 86-73-7 | mg/kg | | 0.053 J | 0.085 | | 0.055 J | | 0.063 | 0.1 | 0.048 J | | 0.038 J | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | | 0.37 | 0.26 | | 0.38 | | 0.51 | 0.64 | 0.53 | | 0.67 | |
| Naphthalene | 91-20-3 | mg/kg | | 0.046 J | 0.024 J | | 0.031 J | | 0.038 J | 0.095 | 0.029 J | | 0.077 U | |
| Phenanthrene | 85-01-8 | mg/kg | | 0.35 | 0.91 | | 0.5 | | 0.56 | 2 | 0.48 | | 0.48 | |
| Phenol | 108-95-2 | mg/kg | | | | | | | 0.06 U | 0.041 U | | | | |
| Pyrene | 129-00-0 | mg/kg | | 0.95 | 1.1 | | 1 | | 1.1 | 2.1 | 1 | | 1.1 | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | | 5.4 | 5.1 | | 6 | | 7 | 11 | 6.3 | | 7.8 | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | | 0.66 | 1.3 | | 0.79 | | 0.91 | 2.6 | 0.74 | | 0.73 | |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | | 6.1 | 6.5 | | 6.8 | | 7.9 | 14 | 7 | | 8.5 | |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED7D | SED7D | SED7E | SED7E | SED7E | SED7F | SED7F | SED7G | SED8.5B | SED8A | SED8A | SED8B |
| | | Sample ID | SED7D00EN | SED7D00N | SED7E00AN | SED7E00EN | SED7E00N | SED7F00EN | SED7F00N | SED7G00N | SED8.5B00N | SED8A00EN | SED8A00N | SED8B00EN |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N | N |
| | | Sample Date | 6/9/2017 | 11/25/2013 | 6/22/2017 | 6/8/2017 | 11/25/2013 | 6/8/2017 | 11/25/2013 | 1/30/2014 | 11/13/2013 | 6/9/2017 | 11/13/2013 | 6/9/2017 |
| | | Depth Interval | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft |
| Chemical | CAS | Units | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | 0.039 J | | | 0.077 | 0.105 | 0.085 | 0.239 | | | 0.022 J | | 0.065 U |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | 0.029 | | | 0.075 | 0.111 | 0.06 | 0.171 | | | 0.014 J | | 0.0089 J |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | 0.058 | | | 0.13 | 0.192 | 0.13 | 0.296 | | | 0.031 | | 0.016 J |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 0.059 J | | | 0.12 | 0.183 | 0.14 | 0.339 | | | 0.14 U | | 0.13 U |
| Acenaphthene | 83-32-9 | mg/kg | 0.031 | | | 0.046 | 0.0678 | 0.044 | 0.122 | | | 0.026 | | 0.022 |
| Acenaphthylene | 208-96-8 | mg/kg | 0.024 | | | 0.02 | 0.0255 | 0.024 | 0.0359 | | | 0.026 | | 0.015 |
| Anthracene | 120-12-7 | mg/kg | 0.097 | | | 0.1 | 0.164 | 0.12 | 0.33 | | | 0.071 | | 0.064 |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.98 | | | 1.1 | 0.658 | 0.86 | 1.33 J | | | 0.77 | | 0.71 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 1.2 | | | 0.88 | 0.91 | 1.1 | 1.96 | | | 0.9 | | 0.75 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 1.9 | | | 1.6 | 1.37 | 1.9 | 2.87 | | | 1.7 | | 1.2 |
| Benzo(e)pyrene | 192-97-2 | mg/kg | 1.1 | | | 0.84 | 0.759 | 1 | 1.62 | | | 0.95 | | 0.68 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 1.1 | | | 0.91 | 0.818 | 1.1 | 1.61 | | | 0.97 | | 0.72 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.89 | | | 0.78 | 0.699 | 0.76 | 1.49 | | | 0.65 | | 0.59 |
| Chrysene | 218-01-9 | mg/kg | 1.6 | | | 1.5 | 1.38 | 1.5 | 2.56 | | | 1.4 | | 1 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.2 | | | 0.15 | 0.115 J | 0.17 | 0.166 J | | | 0.19 | | 0.15 |
| Dibenzothiophene | 132-65-0 | mg/kg | 0.048 | | | 0.075 | 0.104 | 0.057 | 0.136 | | | 0.033 | | 0.031 |
| Fluoranthene | 206-44-0 | mg/kg | 1.7 | | | 1.7 | 1.75 | 1.6 | 3.22 | | | 1.6 | | 1.4 |
| Fluorene | 86-73-7 | mg/kg | 0.054 | | | 0.088 | 0.128 | 0.075 | 0.18 | | | 0.043 | | 0.034 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.89 | | | 0.72 | 0.584 | 0.79 | 1.18 | | | 0.79 | | 0.57 |
| Naphthalene | 91-20-3 | mg/kg | 0.24 U | | | 0.087 J | 0.117 J | 0.094 J | 0.204 J | | | 0.27 U | | 0.26 U |
| Perylene | 198-55-0 | mg/kg | 0.4 | | | 0.24 | 0.257 | 0.32 | 0.339 J | | | 0.32 | | 0.26 |
| Phenanthrene | 85-01-8 | mg/kg | 0.53 | | | 0.82 | 0.788 | 0.75 | 1.87 | | | 0.54 | | 0.6 |
| Pyrene | 129-00-0 | mg/kg | 1.5 | | | 1.4 | 1.57 | 1.5 | 2.94 | | | 1.3 | | 1.2 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 12 | | | 11 | 9.85 | 11 | 19.3 | | | 10 | | 8.3 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 0.74 | | | 1.2 | 1.29 | 1.1 | 2.74 | | | 0.71 | | 0.74 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 13 | | | 12 | 11.1 | 12 | 22.1 | | | 11 | | 9 |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | | | | | | | 0.014 U | 0.0058 U | | | | |
| Acetone | 67-64-1 | mg/kg | | | | | | | 0.057 U | 0.023 U | | | | |
| Chloroform | 67-66-3 | mg/kg | | | | | | | 0.014 U | 0.0058 U | | | | |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
N (Sample type) - Normal sample.
PCBs - Polychlorinated biphenyls.
U - Not detected.

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED8B | SED8C | SED8C | SED8C | SED9.5B | SED9A | SED9B | SED9C | WSED1 | WSED1 | WSED2 |
| | | Sample ID | SED8B00N | SED8C00EN | SED8C00N | SED8C00R | SED9.5B00N | SED9A00N | SED9B00N | SED9C00N | WSED100N | WSED100R | WSED200N |
| | | Sample Type | N | N | N | FD | N | N | N | N | N | FD | N |
| | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 11/14/2013 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/15/2013 | 11/15/2013 | 11/15/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | mg/kg | | 2.14E-05 | 7.04E-06 JN | 1.39E-05 JN | | | | 2.73E-06 J | 2.9E-05 J | 1.16E-05 JN | 1.87E-05 JN |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | mg/kg | | 0.000125 | 3.68E-05 J | 6.46E-05 J | | | | 1.38E-05 | 0.000136 J | 4E-05 J | 7.52E-05 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | mg/kg | | 1.77E-06 J | 1.03E-06 JN | 1.31E-06 JN | | | | 3.25E-07 JN | 2.82E-06 J | 7.25E-07 JN | 1.58E-06 JN |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | mg/kg | | 2.75E-06 | 1.4E-06 JN | 2.47E-06 JN | | | | 3.51E-07 JN | 7.4E-06 J | 1.34E-06 JN | 2.54E-06 JN |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | mg/kg | | 2.57E-06 | 7.47E-07 J | 1.43E-06 J | | | | 3.93E-07 JN | 3.67E-06 J | 9.59E-07 JN | 1.97E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | mg/kg | | 2.82E-06 | 2.65E-06 JN | 4.43E-06 JN | | | | 5.55E-07 JN | 6.2E-06 JN | 1.81E-06 JN | 3.55E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | mg/kg | | 5.4E-06 | 2.09E-06 J | 3.56E-06 J | | | | 6.53E-07 JN | 8.47E-06 J | 2.09E-06 J | 3.64E-06 J |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | mg/kg | | 2.42E-07 U | 1.25E-07 J | 1.31E-07 JN | | | | 2.1E-08 U | 5.01E-07 J | 8.49E-08 JN | 3.01E-07 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | mg/kg | | 4.83E-06 | 1.92E-06 J | 3.77E-06 J | | | | 8.78E-07 JN | 1.02E-05 J | 2.47E-06 J | 3.96E-06 J |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | | 1.29E-06 J | 5.33E-07 JN | 6.99E-07 JN | | | | 1.13E-07 JN | 2.26E-06 JN | 5.23E-07 JN | 1.25E-06 JN |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | mg/kg | | 1.71E-06 JN | 9.24E-07 JN | 1.55E-06 JN | | | | 5.09E-07 JN | 4.53E-06 JN | 7.58E-07 J | 1.65E-06 JN |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | mg/kg | | 4.06E-06 | 9.04E-07 JN | 1.46E-06 J | | | | 3.39E-07 JN | 4.02E-06 J | 9.24E-07 JN | 1.89E-06 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | mg/kg | | 5.56E-06 J | 1E-06 JN | 1.95E-06 JN | | | | 3.45E-07 J | 4.93E-06 J | 9.66E-07 J | 2.33E-06 JN |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | mg/kg | | 1.73E-06 | 7.66E-07 JN | 1.56E-06 | | | | 1.27E-07 JN | 3.07E-06 J | 6.99E-07 J | 1.96E-06 JN |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | mg/kg | | 4.97E-07 | 5.02E-08 JN | 5.78E-07 J | | | | 1.5E-08 U | 1.05E-06 JN | 2.75E-07 JN | 4.15E-08 U |
| Octachlorochlorodibenzofuran | 39001-02-0 | mg/kg | | 4.72E-05 | 1.3E-05 JN | 1.92E-05 | | | | 4.21E-06 J | 3.96E-05 JN | 1.46E-05 JN | 2.36E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | mg/kg | | 0.00366 | 0.000973 J | 0.00181 J | | | | 0.000338 | 0.00382 J | 0.000902 J | 0.0018 |
| **Metals** | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 5500 | 10000 | 6600 | 7700 | 4500 | 8800 | 5600 | 6300 | 7900 | 6100 | 8700 |
| Antimony | 7440-36-0 | mg/kg | 0.38 J- | 0.89 | 0.35 J- | 0.31 J- | 0.27 J- | 0.43 J- | 0.31 J- | 0.48 J- | 0.44 J- | 0.59 J- | 0.74 J- |
| Arsenic | 7440-38-2 | mg/kg | 2 J- | 5.1 | 3 J- | 3.6 J- | 2.1 J- | 3.2 J- | 3.3 J- | 2.5 J- | 3 | 2.4 | 4 J- |
| Barium | 7440-39-3 | mg/kg | 68 | 99 | 63 | 71 | 44 J+ | 88 J+ | 57 J+ | 66 J+ | 89 | 71 | 97 |
| Beryllium | 7440-41-7 | mg/kg | 0.82 | 1.4 | 0.85 | 1 | 0.67 | 1.1 | 0.83 | 0.91 | 1 | 0.94 | 1.3 J |
| Cadmium | 7440-43-9 | mg/kg | 0.61 | 0.82 | 0.8 | 0.89 | 0.35 | 0.88 | 0.43 | 0.59 | 1.5 | 0.64 | 0.95 |
| Calcium | 7440-70-2 | mg/kg | 2200 | 3600 | 2200 J- | 2400 J- | 1500 J- | 2000 J- | 1600 J- | 1900 J- | 1700 J | 2200 J | 3500 |
| Chromium | 7440-47-3 | mg/kg | 25 | 42 | 37 | 41 | 18 J+ | 68 J+ | 20 J+ | 24 J+ | 34 J+ | 29 J+ | 42 |
| Cobalt | 7440-48-4 | mg/kg | 12 | 18 | 14 | 16 | 9.1 J | 12 J | 8.4 J | 12 J | 14 | 16 | 22 |
| Copper | 7440-50-8 | mg/kg | 38 | 59 | 44 | 52 | 21 | 38 | 27 | 30 | 41 | 41 | 59 |
| Iron | 7439-89-6 | mg/kg | 17000 | 27000 | 19000 | 21000 | 12000 | 21000 | 14000 | 17000 | 19000 | 19000 | 25000 |
| Lead | 7439-92-1 | mg/kg | 46 | 55 | 56 | 62 | 36 J | 61 J | 44 J | 49 J | 160 J | 47 J | 70 J |
| Magnesium | 7439-95-4 | mg/kg | 2100 | 3600 | 2000 | 2300 | 1900 | 2400 | 1900 | 2500 | 2600 | 2600 | 3300 |
| Manganese | 7439-96-5 | mg/kg | 290 | 350 | 280 | 330 | 140 | 310 | 240 | 230 | 260 | 240 | 310 |
| Mercury | 7439-97-6 | mg/kg | 0.12 J- | 0.21 | 0.16 J+ | 0.17 J+ | 0.2 | 0.29 | 0.18 | 0.15 | 0.19 | 0.34 | 0.15 |
| Nickel | 7440-02-0 | mg/kg | 21 | 35 | 25 | 28 | 15 | 19 | 16 | 20 | 32 | 29 | 39 J- |
| Potassium | 7440-09-7 | mg/kg | 750 | 1200 | 870 | 980 | 670 | 920 | 580 | 880 | 1200 | 1200 | 1400 |
| Selenium | 7782-49-2 | mg/kg | 0.74 J- | 1 | 1 J- | 1.2 J- | 0.19 J | 0.76 | 0.16 J | 0.53 | 0.93 J- | 0.91 J- | 1.5 J- |
| Silver | 7440-22-4 | mg/kg | 0.26 | 0.27 | 0.29 | 0.43 | 0.15 | 0.69 | 0.17 | 0.18 | 0.72 J | 0.19 J | 0.51 J |
| Sodium | 7440-23-5 | mg/kg | 90 | 200 | 89 J- | 89 J- | 74 | 120 | 87 | 97 | 130 | 120 | 170 |
| Thallium | 7440-28-0 | mg/kg | 0.14 | 0.22 | 0.16 J- | 0.18 J- | 0.12 | 0.2 | 0.12 | 0.16 | 0.17 | 0.18 | 0.26 |
| Vanadium | 7440-62-2 | mg/kg | 23 | 39 | 29 | 36 | 25 J+ | 35 J+ | 35 J+ | 29 J+ | 36 | 25 | 37 |
| Zinc | 7440-66-6 | mg/kg | 140 J- | 240 | 180 | 210 | 97 J+ | 150 J+ | 100 J+ | 130 J+ | 220 J | 170 J | 250 |
| **Other** | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | ug/kg | | | | | | | | | | | |
| PH | PH | ph units | | | | | | | | | | | |
| Total Organic Carbon | TOC | mg/kg | | | | | | | | | | | |
| Total Organic Carbon | 7440-44-0 | mg/kg | 25000 | 44000 | 29000 | 36000 | 39000 | 30000 | 35000 | 33000 | 40000 J | 54000 J | 60000 |
| **PCBs/Pesticides** | | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | | 0.0051 J | 0.0093 J | 0.0039 J | | | | 0.003 J | 0.0064 J | 0.0065 J | 0.012 J |
| 4,4'-DDE | 72-55-9 | mg/kg | | 0.013 | 0.03 J | 0.011 J | | | | 0.0071 | 0.008 J | 0.0073 J | 0.013 J |
| 4,4'-DDT | 50-29-3 | mg/kg | | 0.0011 U | 0.0055 J | 0.00084 UJ | | | | 0.0025 J | 0.004 J | 0.0048 J | 0.0072 J |
| Aldrin | 309-00-2 | mg/kg | | 0.0011 U | 0.00023 J | 0.00076 J | | | | 0.0006 J | 0.003 J | 0.0008 J | 0.0017 J |
| alpha-BHC | 319-84-6 | mg/kg | | 0.0011 U | 0.00078 U | 0.00084 U | | | | 0.00082 U | 0.00063 U | 0.00083 U | 0.0013 U |
| Aroclor-1242 | 53469-21-9 | mg/kg | 0.0081 U | 0.0055 U | 0.0078 U | 0.0084 U | 0.0084 U | 0.009 U | 0.01 U | 0.0082 U | 0.0062 U | 0.0083 U | 0.013 U |
| Aroclor-1248 | 12672-29-6 | mg/kg | 0.069 J | 0.064 J+ | 0.38 J | 0.29 J | 0.3 J | 0.009 U | 0.12 J | 0.12 J | 0.25 J | 0.086 J | 0.11 J |
| Aroclor-1254 | 11097-69-1 | mg/kg | 0.0081 U | 0.081 J+ | 0.0078 U | 0.0084 U | 0.0084 U | 0.009 U | 0.01 U | 0.0082 U | 0.0062 U | 0.0083 U | 0.013 U |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | SED8B | SED8C | SED8C | SED8C | SED9.5B | SED9A | SED9B | SED9C | WSED1 | WSED1 | WSED2 |
| | | Sample ID | SED8B00N | SED8C00EN | SED8C00N | SED8C00R | SED9.5B00N | SED9A00N | SED9B00N | SED9C00N | WSED100N | WSED100R | WSED200N |
| | | Sample Type | N | N | N | FD | N | N | N | N | N | FD | N |
| | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 11/14/2013 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/15/2013 | 11/15/2013 | 11/15/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | |
| Aroclor-1260 | 11096-82-5 | mg/kg | 0.034 J | 0.11 J+ | 0.21 J | 0.12 J | 0.084 J | 0.074 J | 0.057 J | 0.054 J | 0.077 J | 0.036 J | 0.063 J |
| beta-BHC | 319-85-7 | mg/kg | | 0.0011 U | 0.00079 J | 0.00054 J | | | | 0.00082 U | 0.00063 U | 0.00083 U | 0.0013 U |
| CHLORDANE (ALL) | CHLORDANE_ALL | mg/kg | | | | | | | | | | | |
| Chlordane (Technical) | 12789-03-6 | mg/kg | | | | | | | | | | | |
| cis-Chlordane | 5103-71-9 | mg/kg | | 0.016 | 0.0056 J | 0.0049 J | | | | 0.0066 J | 0.018 J | 0.009 J | 0.015 J |
| delta-BHC | 319-86-8 | mg/kg | | 0.0011 U | 0.0015 J | 0.00032 J | | | | 0.00082 U | 0.002 J | 0.00032 J | 0.001 J |
| Dieldrin | 60-57-1 | mg/kg | | 0.004 | 0.00078 U | 0.0023 | | | | 0.0014 J | 0.00063 U | 0.0017 J | 0.0027 J |
| Endosulfan I | 959-98-8 | mg/kg | | 0.0011 U | 0.00078 U | 0.00084 U | | | | 0.00082 U | 0.00063 U | 0.00083 U | 0.0013 U |
| Endosulfan II | 33213-65-9 | mg/kg | | 0.0011 U | 0.0012 J | 0.00055 J | | | | 0.00023 J | 0.0006 J | 0.00038 J | 0.00089 J |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | | 0.0011 U | 0.0027 | 0.0012 | | | | 0.00028 J | 0.0015 | 0.00083 J | 0.00032 J |
| Endrin | 72-20-8 | mg/kg | | 0.0011 U | 0.0054 J | 0.0025 J | | | | 0.0029 | 0.0067 J | 0.0018 J | 0.0032 J |
| Endrin aldehyde | 7421-93-4 | mg/kg | | 0.0011 U | 0.0013 J | 0.00061 J | | | | 0.00068 J | 0.0014 | 0.0018 J | 0.0011 J |
| Endrin ketone | 53494-70-5 | mg/kg | | 0.0011 U | 0.00078 U | 0.0018 J | | | | 0.0031 | 0.00063 U | 0.0038 J | 0.0061 J |
| gamma-BHC (Lindane) | 58-89-9 | mg/kg | | 0.0011 U | 0.0003 J | 0.00084 U | | | | 0.00023 J | 0.00015 J | 0.0003 J | 0.0014 J |
| Heptachlor | 76-44-8 | mg/kg | | 0.0011 U | 0.0022 J | 0.0013 J | | | | 0.0015 | 0.0071 J | 0.0016 J | 0.0038 J |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | | 0.00085 J | 0.0019 J | 0.00084 J | | | | 0.00065 J | 0.0012 J | 0.00099 J | 0.0013 J |
| Methoxychlor | 72-43-5 | mg/kg | | 0.0011 U | 0.012 J | 0.011 J | | | | 0.013 | 0.0083 J | 0.012 J | 0.027 J |
| PCB, TOTAL | PCB | mg/kg | | | | | 0.17 | | | | | | |
| PCB, Total Congeners | TOTCONG | mg/kg | | | | | 0.17 | | | | | | |
| PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | mg/kg | 0.1 | 0.26 | 0.59 | 0.41 | 0.38 | 0.074 | 0.18 | 0.17 | 0.33 | 0.12 | 0.17 |
| trans-Chlordane | 5103-74-2 | mg/kg | | 0.013 | 0.0095 | 0.0077 | | | | 0.011 | 0.031 J | 0.013 J | 0.024 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 92-52-4 | mg/kg | | | 0.15 U | 0.33 U | | | | 0.32 U | 0.25 U | 0.33 U | 0.52 U |
| 2,4-Dimethylphenol | 105-67-9 | mg/kg | | | 0.15 U | 0.33 U | | | | 0.32 U | 0.25 U | 0.33 U | 0.52 U |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | | 0.033 | 0.023 J | | | | 0.0092 J | 0.054 | 0.021 J | 0.022 J |
| 4-Chloroaniline | 106-47-8 | mg/kg | | | 0.15 U | 0.33 U | | | | 0.32 U | 0.057 J | 0.33 U | 0.52 U |
| 4-Methylphenol | 106-44-5 | mg/kg | | | 0.15 U | 0.33 U | | | | 0.32 U | 0.11 J | 0.33 U | 0.52 U |
| Acenaphthene | 83-32-9 | mg/kg | 0.023 J | | 0.0089 J | 0.067 U | 0.017 J | 0.033 J | 0.077 J | 0.016 J | 0.037 J | 0.061 J | 0.11 U |
| Acenaphthylene | 208-96-8 | mg/kg | 0.046 J | | 0.034 | 0.06 J | 0.049 J | 0.11 | 0.047 J | 0.056 J | 0.035 J | 0.055 J | 0.064 J |
| Acetophenone | 98-86-2 | mg/kg | | | 0.15 U | 0.33 U | | | | 0.32 U | 0.03 J | 0.035 J | 0.52 U |
| Anthracene | 120-12-7 | mg/kg | 0.072 | | 0.049 | 0.077 | 0.087 | 0.12 | 0.12 | 0.095 | 0.049 J | 0.28 J | 0.12 |
| Benzaldehyde | 100-52-7 | mg/kg | | | 0.057 J | R | | | | 0.063 J | 0.25 UJ | 0.087 J | 0.14 J |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 0.33 | | 0.32 | 0.45 | 0.45 | 0.48 | 0.4 | 0.48 | 0.26 J | 1 J | 0.69 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 0.42 | | 0.39 | 0.63 | 0.54 | 0.59 | 0.47 | 0.62 | 0.25 J | 1.1 J | 0.79 |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | 0.73 | | 0.24 J | 0.92 J | 0.88 | 0.83 | 0.76 | 0.99 | 0.43 J | 1.8 J | 1.5 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 0.58 | | 0.3 J | 0.77 J | 0.56 | 0.67 | 0.5 | 0.74 | 0.12 J | 0.4 J | 0.36 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 0.28 | | 0.57 | 0.41 | 0.2 | 0.33 | 0.25 | 0.29 | 0.089 J | 0.5 J | 0.5 |
| Benzoic acid | 65-85-0 | mg/kg | | | | | | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | | | 1.3 | 1.8 | | | | 1.5 | 1.6 | 1.3 | 1.5 |
| Caprolactam | 105-60-2 | mg/kg | | | 0.39 J | 1.7 U | | | | 1.7 U | 1.3 U | 1.7 U | 2.7 U |
| Carbazole | 86-74-8 | mg/kg | | | 0.03 J | 0.075 | | | | 0.09 | 0.051 U | 0.17 | 0.096 J |
| Chrysene | 218-01-9 | mg/kg | 0.66 | | 0.53 | 0.75 | 0.79 | 0.77 | 0.7 | 0.88 | 0.4 J | 1.4 J | 1.3 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 0.079 | | 0.031 U | 0.16 | 0.12 | 0.14 | 0.089 | 0.14 | 0.051 U | 0.12 | 0.15 |
| Dibenzofuran | 132-64-9 | mg/kg | | | 0.15 U | 0.33 U | | | | 0.32 U | 0.25 U | 0.33 U | 0.52 U |
| Diethylphthalate | 84-66-2 | mg/kg | | | 0.035 J | 0.12 J | | | | 0.32 U | 0.25 U | 0.33 U | 0.52 U |
| Di-n-butylphthalate | 84-74-2 | mg/kg | | | 0.023 J | 0.33 U | | | | 0.32 U | 0.25 U | 0.33 U | 0.52 U |
| Di-n-octylphthalate | 117-84-0 | mg/kg | | | 0.15 U | 0.33 U | | | | 0.32 U | 0.25 U | 0.24 J | 0.52 U |
| Fluoranthene | 206-44-0 | mg/kg | 0.66 | | 0.67 | 0.97 | 0.92 | 1 | 0.95 | 0.95 | 0.69 J | 2.7 J | 1.8 |
| Fluorene | 86-73-7 | mg/kg | 0.022 J | | 0.026 J | 0.033 J | 0.022 J | 0.043 J | 0.05 J | 0.032 J | 0.061 | 0.091 | 0.052 J |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 0.43 | | 0.27 J | 0.62 J | 0.43 | 0.55 | 0.41 | 0.57 | 0.12 J | 0.44 J | 0.38 |
| Naphthalene | 91-20-3 | mg/kg | 0.017 J | | 0.022 J | 0.067 U | 0.067 U | 0.073 U | 0.081 U | 0.066 U | 0.022 J | 0.023 J | 0.11 U |
| Phenanthrene | 85-01-8 | mg/kg | 0.25 | | 0.22 | 0.31 | 0.37 | 0.42 | 0.47 | 0.39 | 0.36 J | 1.1 J | 0.63 |
| Phenol | 108-95-2 | mg/kg | | | 0.031 U | 0.067 U | | | | 0.066 U | 0.051 U | 0.067 U | 0.11 U |
| Pyrene | 129-00-0 | mg/kg | 0.73 | | 0.66 | 0.93 | 0.92 | 0.84 | 0.81 | 1.1 | 0.54 J | 1.6 J | 1.3 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 4.9 | | 4 | 6.6 | 5.8 | 6.2 | 5.3 | 6.8 | 2.9 | 11 | 8.8 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 0.43 | | 0.36 | 0.48 | 0.55 | 0.73 | 0.76 | 0.59 | 0.56 | 1.6 | 0.87 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 5.3 | | 4.3 | 7.1 | 6.4 | 6.9 | 6.1 | 7.3 | 3.5 | 13 | 9.6 |

**Attachment A Table 1**
**Analytical Data - Sediment**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED8B | SED8C | SED8C | SED8C | SED9.5B | SED9A | SED9B | SED9C | WSED1 | WSED1 | WSED2 |
| | | Sample ID | SED8B00N | SED8C00EN | SED8C00N | SED8C00R | SED9.5B00N | SED9A00N | SED9B00N | SED9C00N | WSED100N | WSED100R | WSED200N |
| | | Sample Type | N | N | N | FD | N | N | N | N | N | FD | N |
| | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 11/14/2013 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/11/2013 | 11/15/2013 | 11/15/2013 | 11/15/2013 |
| | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | Units | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (Method ID0016)** | | | | | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | | 0.028 J | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | | 0.03 | | | | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | | 0.045 | | | | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | | 0.046 J | | | | | | | | | |
| Acenaphthene | 83-32-9 | mg/kg | | 0.027 | | | | | | | | | |
| Acenaphthylene | 208-96-8 | mg/kg | | 0.025 | | | | | | | | | |
| Anthracene | 120-12-7 | mg/kg | | 0.09 | | | | | | | | | |
| Benzo(a)anthracene | 56-55-3 | mg/kg | | 0.83 | | | | | | | | | |
| Benzo(a)pyrene | 50-32-8 | mg/kg | | 0.96 | | | | | | | | | |
| Benzo(b)fluoranthene | 205-99-2 | mg/kg | | 1.8 | | | | | | | | | |
| Benzo(e)pyrene | 192-97-2 | mg/kg | | 0.95 | | | | | | | | | |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | | 1 | | | | | | | | | |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | | 0.84 | | | | | | | | | |
| Chrysene | 218-01-9 | mg/kg | | 1.4 | | | | | | | | | |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | | 0.18 | | | | | | | | | |
| Dibenzothiophene | 132-65-0 | mg/kg | | 0.042 | | | | | | | | | |
| Fluoranthene | 206-44-0 | mg/kg | | 1.6 | | | | | | | | | |
| Fluorene | 86-73-7 | mg/kg | | 0.049 | | | | | | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | | 0.76 | | | | | | | | | |
| Naphthalene | 91-20-3 | mg/kg | | 0.26 U | | | | | | | | | |
| Perylene | 198-55-0 | mg/kg | | 0.39 | | | | | | | | | |
| Phenanthrene | 85-01-8 | mg/kg | | 0.58 | | | | | | | | | |
| Pyrene | 129-00-0 | mg/kg | | 1.4 | | | | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | | 11 | | | | | | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | | 0.77 | | | | | | | | | |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | | 12 | | | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | | | | | | | |
| 2-Butanone | 78-93-3 | mg/kg | | | 0.011 U | 0.014 U | | | | 0.011 U | 0.0079 U | 0.014 U | 0.019 U |
| Acetone | 67-64-1 | mg/kg | | | 0.045 U | 0.057 U | | | | 0.045 U | 0.032 U | 0.057 U | 0.076 U |
| Chloroform | 67-66-3 | mg/kg | | | 0.011 U | 0.014 U | | | | 0.011 U | 0.0079 U | 0.014 U | 0.019 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
N (Sample type) - Normal sample.
PCBs - Polychlorinated biphenyls.
U - Not detected.

**Attachment A Table 2**
**Analytical Data - Pore Water**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| **Location Group** | | | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location ID** | | | SED6.5D | SED6.5E | SED6A | SED6B | SED6C | SED7.5D | SED7.5E | SED7A | SED7B | SED7D | SED7E |
| **Sample ID** | | | PW6.5D00EN | PW6.5E00EN | PW6A00EN | PW6B00EN | PW6C00EN | PW7.5D00EN | PW7.5E00EN | PW7A00EN | PW7B00EN | PW7D00EN | PW7E00EN |
| **Sample Date** | | | 6/9/2017 | 6/8/2017 | 6/8/2017 | 6/8/2017 | 6/7/2017 | 6/9/2017 | 6/8/2017 | 6/9/2017 | 6/7/2017 | 6/9/2017 | 6/8/2017 |
| **Sample Type** | | | N | N | N | N | N | N | N | N | N | N | N |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | | |
| **Metals - Dissolved Phase** | | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | ug/l | 1.3 | 1.1 | 2.5 | 2.1 | 1.1 | 1.1 | 1.0 U | 3.2 | 1.6 | 1.8 | 1.1 |
| Barium | 7440-39-3 | ug/l | 92 | 90 | 130 | 98 | 74 | 92 | 120 | 180 | 85 | 79 | 99 |
| Calcium | 7440-70-2 | ug/l | 58000 | 65000 | 120000 | 120000 | 80000 | 54000 | 51000 | 150000 | 81000 | 58000 | 58000 |
| Chromium | 7440-47-3 | ug/l | 0.46 J | 2.0 U | 0.49 J | 2.0 U | 0.46 J | 0.38 J | 0.38 J | 0.64 J | 0.99 J | 0.47 J | 0.38 J |
| Cobalt | 7440-48-4 | ug/l | 1.0 | 0.81 | 15 | 9.2 | 5.5 | 2.0 | 0.30 J | 19 | 4.8 | 2.2 | 0.91 |
| Iron | 7439-89-6 | ug/l | 6700 | 7200 | 61000 | 17000 | 4400 | 6700 | 5700 | 67000 | 4700 | 7300 | 7200 |
| Magnesium | 7439-95-4 | ug/l | 17000 | 20000 | 24000 | 26000 | 20000 | 14000 | 14000 | 35000 | 21000 | 17000 | 16000 |
| Manganese | 7439-96-5 | ug/l | 1800 | 2300 | 9000 | 7100 | 4100 | 1800 | 1300 | 11000 | 2800 | 1800 | 1400 |
| Nickel | 7440-02-0 | ug/l | 1.6 | 1.5 | 2.6 | 2.4 | 1.8 | 1.3 | 0.89 J | 3.8 | 1.2 | 1.3 | 1.6 |
| Sodium | 7440-23-5 | ug/l | 49000 | 46000 | 56000 | 53000 | 48000 | 51000 | 47000 | 57000 | 50000 | 42000 | 48000 |
| Vanadium | 7440-62-2 | ug/l | 1.0 U | 0.69 J | 1.0 U | 0.61 J | 0.66 J | 1.0 U | 0.68 J | 1.0 U | 0.60 J | 1.0 U | 0.74 J |
| Zinc | 7440-66-6 | ug/l | 5.0 U | 5.0 U | 6.4 | 3.1 J | 2.9 J | 5.0 U | 5.0 U | 3.6 J | 3.2 J | 3.8 J | 5.0 U |
| **Metals - Total Phase** | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | ug/l | 95 | 160 | 81 | 42 | 77 | 360 | 69 | 41 | 58 | 28 J | 110 |
| Antimony | 7440-36-0 | ug/l | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 3.3 | 2.0 U | 2.0 U |
| Arsenic | 7440-38-2 | ug/l | 3.5 | 3.8 | 5.1 | 6.0 | 4.5 | 4.5 | 1.6 | 7.1 | 4.7 | 3.3 | 2.6 |
| Barium | 7440-39-3 | ug/l | 110 | 140 | 240 | 230 | 140 | 140 | 160 | 340 | 130 | 96 | 120 |
| Cadmium | 7440-43-9 | ug/l | 1.0 U | 1.0 U | 1.0 U | 0.10 J | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Calcium | 7440-70-2 | ug/l | 55000 | 65000 | 110000 | 120000 | 86000 | 55000 | 52000 | 160000 | 83000 | 57000 | 58000 |
| Chromium | 7440-47-3 | ug/l | 0.91 J | 0.91 J | 1.0 J | 0.64 J | 1.2 J | 1.9 J | 0.64 J | 1.2 J | 5.4 | 0.51 J | 0.84 J |
| Cobalt | 7440-48-4 | ug/l | 1.3 | 1.2 | 16 | 11 | 6.9 | 2.7 | 0.44 J | 23 | 5.6 | 1.9 | 0.92 |
| Copper | 7440-50-8 | ug/l | 2.7 | 2.6 | 2.0 | 1.3 J | 3.1 | 6.5 | 2.7 | 3.2 | 4.4 | 1.1 J | 2.2 |
| Iron | 7439-89-6 | ug/l | 21000 | 26000 | 100000 | 66000 | 30000 | 26000 | 18000 | 110000 | 28000 | 13000 | 19000 |
| Lead | 7439-92-1 | ug/l | 2.9 | 7.1 | 1.1 | 0.50 J | 2.6 | 6.8 | 1.5 | 2.0 | 4.4 | 0.63 J | 2.1 |
| Magnesium | 7439-95-4 | ug/l | 16000 | 19000 | 23000 | 25000 | 21000 | 15000 | 14000 | 35000 | 21000 | 16000 | 16000 |
| Manganese | 7439-96-5 | ug/l | 1700 | 2300 | 9300 | 7500 | 4500 | 1800 | 1300 | 13000 | 3000 | 1700 | 1300 |
| Nickel | 7440-02-0 | ug/l | 2.6 | 2.5 | 3.1 | 2.8 | 2.7 | 2.6 | 1.5 | 4.8 | 1.6 | 1.4 | 2.0 |
| Sodium | 7440-23-5 | ug/l | 45000 | 45000 | 55000 | 51000 | 51000 | 51000 | 48000 | 58000 | 50000 | 41000 | 47000 |
| Vanadium | 7440-62-2 | ug/l | 2.6 | 3.2 | 1.2 | 0.97 J | 1.8 | 5.2 | 2.6 | 1.5 | 1.3 | 1.0 | 3.3 |
| Zinc | 7440-66-6 | ug/l | 8.1 | 9.0 | 4.9 J | 4.4 J | 11 | 13 | 7.5 | 6.3 | 6.8 | 5.0 U | 6.4 |
| **Other** | | | | | | | | | | | | | |
| Dissolved Organic Carbon | DOC | mg/l | 7.9 | 20 | 15 | 78 | 26 | 7.4 | 6.2 | 26 | 85 | 8.0 | 6.9 |
| Hardness (as CaCO3) | HARD | mg/l | 210 | 240 | 390 | 400 | 280 | 190 | 190 | 510 | 290 | 210 | 210 |
| Particulate Organic Carbon | PTOC | mg/l | 4200 | 1900 | 5200 | 580 | 950 | 1200 | 720 | 1000 | 520 | 570 | 560 |
| Hardness (as CaCO3) | HARD | mg/l | 200 | 240 | 370 | 400 | 300 | 200 | 190 | 540 | 290 | 210 | 210 |

**Attachment A Table 2**
**Analytical Data - Pore Water**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | SED6.5D | SED6.5E | SED6A | SED6B | SED6C | SED7.5D | SED7.5E | SED7A | SED7B | SED7D | SED7E |
| | | Sample ID | PW6.5D00EN | PW6.5E00EN | PW6A00EN | PW6B00EN | PW6C00EN | PW7.5D00EN | PW7.5E00EN | PW7A00EN | PW7B00EN | PW7D00EN | PW7E00EN |
| | | Sample Date | 6/9/2017 | 6/8/2017 | 6/8/2017 | 6/8/2017 | 6/7/2017 | 6/9/2017 | 6/8/2017 | 6/9/2017 | 6/7/2017 | 6/9/2017 | 6/8/2017 |
| | | Sample Type | N | N | N | N | N | N | N | N | N | N | N |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | | |
| **Polychlorinated Biphenyls (PCBs) - Dissolved Phase** | | | | | | | | | | | | | |
| PCB, TOTAL | PCB | ug/l | 0.0028 | 0.0046 | 0.0026 | 0.0026 | 0.0025 | 0.0043 | 0.0064 | 0.0016 | 0.0023 | 0.0038 | 0.01 |
| **Semi-volatile Organic Compounds - Dissolved Phase** | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | ug/l | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 0.15 J | 1.6 U | 1.6 U |
| Fluoranthene | 206-44-0 | ug/l | 0.01 J | 0.02 J | 0.02 J | 0.02 J | 0.03 J | 0.02 J | 0.03 J | 0.02 J | 0.09 J | 0.02 J | 0.02 J |
| Fluorene | 86-73-7 | ug/l | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 0.13 J | 1.2 U | 1.2 U |
| Naphthalene | 91-20-3 | ug/l | 0.22 J | 0.1 J | 0.11 J | 0.13 J | 0.11 J | 0.12 J | 5.7 U | 0.13 J | 0.15 J | 5.7 U | 0.1 J |
| Phenanthrene | 85-01-8 | ug/l | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.31 J | 0.56 U | 0.56 U |
| Pyrene | 129-00-0 | ug/l | 0.02 J | 0.03 J | 0.02 J | 0.02 J | 0.04 J | 0.03 J | 0.03 J | 0.02 J | 0.12 J | 0.03 J | 0.02 J |

Notes:
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
ug/l - Microgram per liter.
mg/l - Milligram per liter.
N - Normal sample.
PCBs - Polychlorinated biphenyls.
SVOCs - Semi-volatile organic compounds.
U - Not detected.

**Attachment A Table 2**
**Analytical Data - Pore Water**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | **Location Group** | Site | Site | Site | Site | Reference | Reference | Reference | Reference | Reference | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Location ID** | SED7F | SED8A | SED8B | SED8C | SEDBACK16 | SEDBACK17 | SEDBACK18 | SEDBACK19 | SEDBACK19 | SEDBACK20 |
| | | **Sample ID** | PW7F00EN | PW8A00EN | PW8B00EN | PW8C00EN | PWBACK1600N | PWBACK1700N | PWBACK1800N | PWBACK1900N | PWBACK1900R | PWBACK2000N |
| | | **Sample Date** | 6/8/2017 | 6/9/2017 | 6/9/2017 | 6/7/2017 | 6/12/2017 | 6/12/2017 | 6/12/2017 | 6/13/2017 | 6/13/2017 | 6/13/2017 |
| | | **Sample Type** | N | N | N | N | N | N | N | N | FD | N |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **Metals - Dissolved Phase** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | ug/l | 1.1 | 1.5 | 3.3 | 1.1 | 2.7 | 1.3 | 1.8 | 1.1 | 1.2 | 4.0 |
| Barium | 7440-39-3 | ug/l | 90 | 110 | 180 | 74 | 340 | 300 | 220 | 310 | 240 | 280 |
| Calcium | 7440-70-2 | ug/l | 69000 | 87000 | 130000 | 60000 | 63000 | 72000 | 55000 | 42000 | 39000 | 75000 |
| Chromium | 7440-47-3 | ug/l | 0.48 J | 0.55 J | 0.46 J | 0.52 J | 0.41 J | 2.0 U | 0.43 J | 2.0 U | 2.0 U | 0.48 J |
| Cobalt | 7440-48-4 | ug/l | 2.6 | 8.3 | 18 | 3.6 | 23 | 16 | 7.8 | 6.5 J | 8.9 J | 21 J |
| Iron | 7439-89-6 | ug/l | 6100 | 17000 | 53000 | 7600 | 26000 | 45000 | 10000 | 210 | 240 | 38000 |
| Magnesium | 7439-95-4 | ug/l | 21000 | 20000 | 27000 | 15000 | 16000 | 15000 | 14000 | 11000 | 10000 | 16000 |
| Manganese | 7439-96-5 | ug/l | 2500 | 5500 | 9500 | 3300 | 9600 | 7600 | 3800 | 2700 | 2800 | 6900 |
| Nickel | 7440-02-0 | ug/l | 2.2 | 2.3 | 3.2 | 1.2 | 6.3 | 5.8 | 4.4 | 5.4 | 5.4 | 9.1 |
| Sodium | 7440-23-5 | ug/l | 48000 | 51000 | 54000 | 46000 | 50000 | 54000 | 51000 | 51000 | 49000 | 48000 |
| Vanadium | 7440-62-2 | ug/l | 0.92 J | 1.0 U | 1.0 U | 0.67 J | 1.0 U | 1.0 U | 0.52 J | 0.50 J | 1.0 U | 1.0 U |
| Zinc | 7440-66-6 | ug/l | 5.0 U | 3.3 J | 3.3 J | 5.0 U | 43 | 42 | 41 | 60 | 47 | 39 |
| **Metals - Total Phase** | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | ug/l | 85 | 150 | 33 | 140 | 3800 J | 830 J | 940 J | 9700 J | 2700 J | 420 J |
| Antimony | 7440-36-0 | ug/l | 2.0 U | 2.0 U | 2.0 U | 2.0 U | 0.82 J | 0.51 J | 0.45 J | 1.7 J | 0.76 J | 2.0 U |
| Arsenic | 7440-38-2 | ug/l | 4.1 | 5.4 | 6.7 | 3.2 | 5.8 | 3.3 | 4.9 | 7.2 J | 3.8 J | 5.5 J |
| Barium | 7440-39-3 | ug/l | 150 | 190 | 310 | 110 | 250 | 240 | 150 | 240 | 180 | 240 |
| Cadmium | 7440-43-9 | ug/l | 0.11 J | 1.0 U | 1.0 U | 1.0 U | 0.20 J | 1.0 U | 1.0 U | 0.59 J | 0.16 J | 1.0 U |
| Calcium | 7440-70-2 | ug/l | 70000 | 88000 | 130000 | 63000 | 66000 J | 72000 | 55000 J | 45000 | 38000 | 78000 |
| Chromium | 7440-47-3 | ug/l | 0.88 J | 1.6 J | 0.73 J | 1.2 J | 13 | 3.3 | 3.4 | 32 J | 8.9 J | 2.1 J |
| Cobalt | 7440-48-4 | ug/l | 3.1 | 11 | 20 | 4.0 | 29 | 17 | 9.0 | 21 J | 14 J | 22 J |
| Copper | 7440-50-8 | ug/l | 2.7 | 6.1 | 1.7 J | 2.7 | 22 | 9.8 | 9.2 | 51 J | 18 J | 4.6 J |
| Iron | 7439-89-6 | ug/l | 27000 | 61000 | 98000 | 22000 | 52000 | 65000 | 25000 | 33000 J | 14000 J | 49000 J |
| Lead | 7439-92-1 | ug/l | 2.4 | 4.1 | 0.58 J | 2.0 | 19 | 6.3 | 8.2 | 51 J | 18 J | 3.9 J |
| Magnesium | 7439-95-4 | ug/l | 21000 | 20000 | 27000 | 16000 | 17000 | 16000 | 14000 | 13000 | 10000 | 17000 |
| Manganese | 7439-96-5 | ug/l | 2600 | 6000 | 9800 | 3400 | 10000 | 7700 | 3900 | 3100 | 2800 | 7200 |
| Nickel | 7440-02-0 | ug/l | 3.4 | 3.5 | 3.7 | 1.9 | 17 | 8.2 | 7.0 | 29 J | 12 J | 11 J |
| Sodium | 7440-23-5 | ug/l | 48000 | 50000 | 52000 | 48000 | 51000 | 53000 | 50000 | 50000 | 47000 | 50000 |
| Vanadium | 7440-62-2 | ug/l | 3.8 | 2.2 | 1.0 | 1.3 | 9.3 | 2.7 | 3.7 | 30 J | 8.8 J | 2.2 J |
| Zinc | 7440-66-6 | ug/l | 9.6 | 8.3 | 3.9 J | 6.7 | 73 | 20 | 21 | 230 J | 79 J | 8.6 J |
| **Other** | | | | | | | | | | | | |
| Dissolved Organic Carbon | DOC | mg/l | 9.2 | 20 | 140 | 9.5 | 15 | 13 | 9.5 | 9.1 | 7.9 | 12 |
| Hardness (as CaCO3) | HARD | mg/l | 260 | 300 | 440 | 210 | 220 | 240 | 200 | 150 | 140 | 250 |
| Particulate Organic Carbon | PTOC | mg/l | 740 | 3300 | 530 | 600 | 17 | 13 | 14 | 31 J | 12 J | 7.4 J |
| Hardness (as CaCO3) | HARD | mg/l | 260 | 300 | 440 | 220 | 230 | 250 | 190 | 170 | 140 | 260 |

**Attachment A Table 2**
**Analytical Data - Pore Water**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | **Location Group** | Site | Site | Site | Site | Reference | Reference | Reference | Reference | Reference | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Location ID** | SED7F | SED8A | SED8B | SED8C | SEDBACK16 | SEDBACK17 | SEDBACK18 | SEDBACK19 | SEDBACK19 | SEDBACK20 |
| | | **Sample ID** | PW7F00EN | PW8A00EN | PW8B00EN | PW8C00EN | PWBACK1600N | PWBACK1700N | PWBACK1800N | PWBACK1900N | PWBACK1900R | PWBACK2000N |
| | | **Sample Date** | 6/8/2017 | 6/9/2017 | 6/9/2017 | 6/7/2017 | 6/12/2017 | 6/12/2017 | 6/12/2017 | 6/13/2017 | 6/13/2017 | 6/13/2017 |
| | | **Sample Type** | N | N | N | N | N | N | N | N | FD | N |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **Polychlorinated Biphenyls (PCBs) - Dissolved Phase** | | | | | | | | | | | | |
| PCB, TOTAL | PCB | ug/l | 0.006 | 0.002 | 0.003 | 0.0021 | 0.0004 | 0.00087 | 0.009 | 0.0056 J | 0.019 J | 0.0019 |
| **Semi-volatile Organic Compounds - Dissolved Phase** | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | ug/l | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 1.6 U |
| Fluoranthene | 206-44-0 | ug/l | 0.02 J | 0.02 J | 0.02 J | 0.03 J | 0.02 J | 0.01 J | 0.01 J | 0.01 J | 0.01 J | 0.02 J |
| Fluorene | 86-73-7 | ug/l | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U |
| Naphthalene | 91-20-3 | ug/l | 0.11 J | 0.13 J | 0.12 J | 0.12 J | 0.17 J | 0.13 J | 5.7 U | 5.7 U | 5.7 U | 0.11 J |
| Phenanthrene | 85-01-8 | ug/l | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U | 0.56 U |
| Pyrene | 129-00-0 | ug/l | 0.02 J | 0.02 J | 0.02 J | 0.03 J | 0.01 J | 0.01 J | 0.02 J | 0.02 J | 0.02 J | 0.03 J |

Notes:
CAS - Chemical Abstracts Service.
FD - Field duplicate.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
ug/l - Microgram per liter.
mg/l - Milligram per liter.
N - Normal sample.
PCBs - Polychlorinated biphenyls.
SVOCs - Semi-volatile organic compounds.
U - Not detected.

## Attachment A Table 3
## Analytical Data - Fish Tissue Data - Food Web Model
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-15 | FT-15 | FT-16 | FT-16 | FT-17 | FT-17 | FT-18 | FT-18 | FT-19 | FT-19 |
| | | Matrix | TA_GSHIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W | TA_MIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W |
| | | Sample ID | RI-R4-FT-15-GF | RI-R4-FT-15-GM | RI-KL-FT-16-GF | RI-KL-FT-16-GM | RI-R4-FT-17-GF | RI-R4-FT-17-GM | RI-KL-FT-18-GF | RI-KL-FT-18-GM | RI-R5-FT-19-GF | RI-R5-FT-19-GM |
| | | Sample Date | 12/30/2014 | 12/30/2014 | 12/30/2014 | 1/15/2015 | 12/30/2014 | 1/15/2015 | 12/30/2014 | 1/19/2015 | 12/30/2014 | 1/7/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.00143 | 0.00078 | 0.00073 | 0.00099 | 0.00090 | 0.00161 | 0.00034 | 0.00049 | 0.00151 | 0.00073 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.00066 | 0.00079 | 0.00025 | 0.00083 | 0.00047 | 0.00132 | 0.00024 | 0.00042 | 0.00066 | 0.00063 |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 323 | 417 | 290 | 368 | 321 | 435 | 334 | 365 | 321 | 300 |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 2.3 | 1.35 | 2.4 | 1.1 | 2.5 | 1.4 | 2.6 | 0.84 | 3.4 | 0.82 |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.078 U | 0.19 U | 0.039 U | 0.088 J | 0.19 U | 0.053 J | 0.21 U | 0.018 U | 0.03 U | 0.24 |
| Cadmium | 7440-43-9 | mg/kg | 0.0092 U | 0.008 U | 0.0068 U | 0.014 J | 0.0069 U | 0.0074 J | 0.0068 U | 0.022 J | 0.0071 U | 0.007 U |
| Copper | 7440-50-8 | mg/kg | 1.5 | 0.585 | 0.68 | 0.61 | 1 | 0.68 | 1.2 | 0.63 | 0.97 | 0.52 |
| Lead | 7439-92-1 | mg/kg | 0.57 | 0.23 | 0.13 U | 0.27 | 0.23 | 0.2 | 0.82 | 0.32 | 0.43 | 0.13 |
| Nickel | 7440-02-0 | mg/kg | 1.3 J | 0.47 | 0.16 | 0.36 | 0.51 | 0.24 | 0.45 | 0.24 | 0.34 | 0.21 |
| Selenium | 7782-49-2 | mg/kg | 0.325 J | 0.43 J | 0.29 J | 0.31 J | 0.36 J | 0.38 J | 0.25 U | 0.43 J | 0.31 J | 0.31 J |
| Silver | 7440-22-4 | mg/kg | 0.0083 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.005 J | 0.0053 U | 0.0039 U | 0.0039 U |
| Zinc | 7440-66-6 | mg/kg | 37.5 | 29.5 | 39 | 28 | 33 | 25 | 29 | 26 | 37 | 28 |
| Mercury | 7439-97-6 | mg/kg | 0.057 J | 0.065 J | 0.069 J | 0.052 U | 0.05 J | 0.055 U | 0.046 U | 0.051 U | 0.065 J | 0.019 J |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 8.6 J | 6.35 J | 8.2 J | 4.2 J | 8 J | 6.6 J | 7.8 J | 3.3 J | 10 J | 5.5 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 17.5 | 18 | 19 | 14 | 16 | 24 | 23 | 14 | 23 | 17 |
| 4,4'-DDT | 50-29-3 | ug/kg | 1.6 J | 1.8 J | 1.4 J | 0.87 J | 1 J | 2.4 J | 2.3 J | 1.6 J | 2.4 J | 1.3 J |
| ALDRIN | 309-00-2 | ug/kg | 2.5 J | 1.3 J | 1.1 J | 0.98 J | 1.6 J | 1.6 J | 1.4 J | 1.1 J | 1.7 J | 0.95 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 140 | 99 | 130 | 71 | 130 | 110 | 140 | 75 | 220 | 96 |
| DIELDRIN | 60-57-1 | ug/kg | 8.5 | 4.8 | 6.3 | 2.7 | 6.6 | 5.5 | 6.5 | 1.9 J | 13 | 4.7 |
| ENDRIN | 72-20-8 | ug/kg | 5.8 J | 4.75 J | 5.4 J | 3.5 J | 4.1 J | 4.8 J | 5.4 J | 3.2 J | 6.5 J | 4.5 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 2.2 J | 2.3 J | 1 | 1.6 J | 1.4 J | 1.2 J | 1.4 | 1.5 J | 1.5 | 1.3 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 4.8 J | 2.45 J | 3.2 J | 1.8 J | 3.4 J | 3.3 J | 2.5 J | 1.6 J | 6.5 J | 2.4 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 U | | 11 U | 11 U | 22 | 11 U | 8.7 | 11 U | 29 | 11 U |

Notes:

CALC - Calculated value.

CAS - Chemical Abstracts Service.

J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.

mg/kg - Milligram per kilogram.

PAH - Polycyclic aromatic hydrocarbons.

PCBs - Polychlorinated biphenyls.

TEQ - Toxic Equivalence.

U - Not detected.

ug/kg - Microgram per kilogram.

**Attachment A Table 3**
**Analytical Data - Fish Tissue Data - Food Web Model**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-20 | FT-20 | FT-21 | FT-21 | FT-22 | FT-22 | FT-23 | FT-23 | FT-24 | FT-24 |
| | | Matrix | TA_BK_W | TA_SUN_W | TA_GSHIN_W | TA_SUN_W | TA_MIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W |
| | | Sample ID | RI-KL-FT-20-GF | RI-KL-FT-20-GM | RI-KL-FT-21-GF | RI-KL-FT-21-GM | RI-R5-FT-22-GF | RI-R5-FT-22-GM | RI-KL-FT-23-GF | RI-KL-FT-23-GM | RI-KL-FT-24-GF | RI-KL-FT-24-GM |
| | | Sample Date | 1/20/2015 | 1/8/2015 | 12/29/2014 | 12/30/2014 | 1/19/2015 | 1/15/2015 | 1/15/2015 | 1/7/2015 | 1/20/2015 | 1/19/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.00054 | 0.00062 | 0.00091 | 0.00020 | 0.00139 | 0.00060 | 0.00111 | 0.00043 | 0.00095 | 0.00088 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.00028 | 0.00057 | 0.00041 | 0.00020 | 0.00111 | 0.00046 | 0.00079 | 0.00043 | 0.00035 | 0.00034 |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 300 | 304 | 294 | 259 | 362 | 385 | 308 | 199 | 354 | 261 |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.3 | 1.1 | 2.6 | 1.3 | 2.4 | 1.2 | 1.9 | 0.6 | 3.5 | 1.9 |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.27 | 0.12 | 0.15 U | 0.047 U | 0.071 J | 0.13 | 0.12 | 0.029 J | 0.2 | 0.38 |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.0069 U | 0.0069 U | 0.013 U | 0.013 J | 0.0069 U | 0.017 J | 0.0068 U | 0.011 J | 0.0069 U |
| Copper | 7440-50-8 | mg/kg | 0.9 | 0.62 | 1.2 | 0.74 | 1.5 | 0.635 | 1.4 | 0.49 | 1.3 | 0.57 |
| Lead | 7439-92-1 | mg/kg | 0.62 | 1 | 0.83 | 0.23 | 1.1 | 0.19 | 0.89 | 0.15 | 0.9 | 0.22 |
| Nickel | 7440-02-0 | mg/kg | 0.42 | 0.35 | 1.2 | 0.12 | 0.75 | 0.22 | 0.68 | 0.63 J | 0.72 | 0.22 |
| Selenium | 7782-49-2 | mg/kg | 0.34 U | 0.32 J | 0.24 U | 0.25 U | 0.4 J | 0.425 J | 0.35 J | 0.29 J | 0.37 J | 0.35 U |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0039 U | 0.0057 J | 0.0038 U | 0.0094 U | 0.0038 U | 0.0047 U | 0.0038 U | 0.0057 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 37 | 29 | 31 | 28 | 42 | 30 | 36 | 31 | 37 | 25 |
| Mercury | 7439-97-6 | mg/kg | 0.042 U | 0.013 U | 0.047 U | 0.078 J | 0.056 U | 0.053 U | 0.054 U | 0.045 | 0.045 U | 0.053 U |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 6.1 J | 3.5 J | 7.7 J | 5.1 J | 9.6 J | 4.3 J | 6 J | 2.2 J | 2.2 J | 5.6 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 17 | 14 | 18 | 18 | 18 | 12.5 | 14 | 12 | 10 | 14 |
| 4,4'-DDT | 50-29-3 | ug/kg | 0.95 J | 1.1 J | 1.6 J | 0.87 J | 1.7 J | 1.7 J | 1.2 J | 9.1 | 0.82 J | 9 |
| ALDRIN | 309-00-2 | ug/kg | 0.96 J | 0.7 J | 1.3 J | 1.1 J | 1.3 J | 0.925 J | 0.94 J | 0.42 J | 0.95 J | 0.91 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 77 | 49 | 130 | 81 | 150 | 85 | 110 | 39 | 42 | 94 |
| DIELDRIN | 60-57-1 | ug/kg | 3.4 | 1.6 J | 5.9 | 3.6 J | 6.5 | 4.3 | 4 | 0.07 U | 2.3 | 4 |
| ENDRIN | 72-20-8 | ug/kg | 3.7 J | 3.4 J | 5.3 J | 5.3 J | 3.6 J | 3.6 J | 4.1 J | 3 J | 1.6 J | 3.4 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 3.5 | 0.96 J | 1.3 J | 1.3 J | 1.7 | 1.45 J | 3.4 | 1.7 J | 0.79 J | 1.1 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 1.5 J | 1.3 J | 2.7 J | 2.1 J | 3.7 J | 2.2 J | 2.7 J | 1 J | 5.3 J | 2.4 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 U | 11 U | 8.6 | 11 U | 11 U | 11 U | 11 | 11 U | 11 U | 11 U |

Notes:

CALC - Calculated value.

CAS - Chemical Abstracts Service.

J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.

mg/kg - Milligram per kilogram.

PAH - Polycyclic aromatic hydrocarbons.

PCBs - Polychlorinated biphenyls.

TEQ - Toxic Equivalence.

U - Not detected.

ug/kg - Microgram per kilogram.

# Attachment A Table 3
## Analytical Data - Fish Tissue Data - Food Web Model
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-25 | FT-25 | FT-26 | FT-27 | FT-27 | FT-28 | FT-28 | FT-29 | FT-29 | FT-30 |
| | | Matrix | TA_MIN_W | TA_SUN_W | TA_MIN_W | TA_MIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W | TA_MIN_W |
| | | Sample ID | RI-KL-FT-25-GF | RI-KL-FT-25-GM | RI-KL-FT-26-GF | RI-KL-FT-27-GF | RI-KL-FT-27-GM | RI-R6-FT-28-GF | RI-R6-FT-28-GM | RI-R6-FT-29-GF | RI-R6-FT-29-GM | RI-R6-FT-30-GF |
| | | Sample Date | 12/29/2014 | 1/12/2015 | 1/5/2015 | 1/23/2015 | 1/25/2015 | 12/29/2014 | 1/20/2015 | 1/20/2015 | 1/8/2015 | 12/29/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.00089 | | 0.00357 | 0.00584 | 0.00197 | 0.00174 | 0.00030 | 0.00038 | 0.00046 | 0.00186 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.00050 | | 0.00190 | 0.00334 | 0.00146 | 0.00132 | 0.00015 | 0.00027 | 0.00036 | 0.00081 |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 341 | | 395 | 396 | 276 | 284 | 390 | 263 | 233 | 438 |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 3.4 | | 3.5 | 3.4 | 0.96 | 2.3 | 1.1 | 1.8 | 1.2 | 4.3 |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.17 U | | 0.19 | 0.25 U | 0.16 U | 0.098 U | 0.094 J | 0.22 | 0.067 J | 0.14 U |
| Cadmium | 7440-43-9 | mg/kg | 0.01 U | | 0.027 J | 0.02 J | 0.0069 U | 0.016 U | 0.015 J | 0.0069 U | 0.022 J | 0.0088 U |
| Copper | 7440-50-8 | mg/kg | 1.3 | | 1.9 | 2 | 0.51 | 1.2 | 0.51 | 1.2 | 0.62 | 1.2 |
| Lead | 7439-92-1 | mg/kg | 0.68 | | 1.5 | 1.5 | 0.2 | 0.51 | 0.17 | 0.35 | 0.17 | 0.46 |
| Nickel | 7440-02-0 | mg/kg | 0.86 | | 1.1 J | 1.1 | 0.14 | 0.75 | 0.43 | 0.4 | 0.41 | 0.79 |
| Selenium | 7782-49-2 | mg/kg | 0.34 J | | 0.37 J | 0.41 J | 0.44 J | 0.22 U | 0.32 U | 0.42 J | 0.36 J | 0.34 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | | 0.0081 J | 0.0054 J | 0.0038 U | 0.0039 U | 0.0038 U | 0.0039 U | 0.0038 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 37 | | 41 | 37 | 26 | 31 | 24 | 44 | 25 | 36 |
| Mercury | 7439-97-6 | mg/kg | 0.045 J | 0.034 U | 0.011 U | 0.052 U | 0.054 U | 0.086 J | 0.04 U | 0.041 U | 0.035 U | 0.041 U |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 11 J | 3.3 J | 9.9 J | 10 J | 5.3 J | 6.5 J | 5.5 J | 3.8 J | 2 J | 9.3 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 19 | 9.9 | 20 | 19 | 12 | 12 | 16 | 9.8 | 7.3 | 17 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2.2 J | 12 | 2.6 J | 3.5 J | 1.9 J | 1.9 J | 1.5 J | 1.4 J | 1.3 J | 1.8 J |
| ALDRIN | 309-00-2 | ug/kg | 1.8 J | 0.4 J | 1.7 J | 1.6 J | 0.99 J | 1.3 J | 1.2 J | 0.85 J | 0.58 J | 2.4 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 190 | 55 | 200 | 210 | 89 | 130 | 120 | 110 | 51 | 190 |
| DIELDRIN | 60-57-1 | ug/kg | 9.5 | 2.1 J | 10 | 10 | 4.2 | 7.8 | 6.5 | 6.5 | 3.4 | 11 |
| ENDRIN | 72-20-8 | ug/kg | 5.8 J | 3.7 J | 5.3 J | 5.4 J | 3.8 J | 4.4 J | 4.6 J | 3.1 J | 2.5 J | 5.5 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 1.4 J | 1.8 J | 1.4 J | 2.4 | 1.7 J | 3.1 | 1.3 J | 4.2 | 1.4 J | 1.8 |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 5.7 J | 1.3 J | 6.2 J | 5.2 J | 2.8 J | 4.5 J | 4.2 J | 4 J | 2.1 J | 7.6 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | | 13 U | 120 | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 26 | | 11 U | 41 | 22 | 19 | 12 | 11 U | 11 U | 40 |

Notes:

CALC - Calculated value.

CAS - Chemical Abstracts Service.

J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.

mg/kg - Milligram per kilogram.

PAH - Polycyclic aromatic hydrocarbons.

PCBs - Polychlorinated biphenyls.

TEQ - Toxic Equivalence.

U - Not detected.

ug/kg - Microgram per kilogram.

**Attachment A Table 3**
**Analytical Data - Fish Tissue Data - Food Web Model**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Upstream | Upstream | Upstream | Upstream | Upstream |
| | | Location ID | FT-30 | FT-31 | FT-31 | FT-32 | FT-32 | FT-33 | FT-33 | FT-34 |
| | | Matrix | TA_SUN_W | TA_MIN_W | TA_SUN_W | TA_MIN_W | TA_SUN_W | TA_MIN_W | TA_SUN_W | TA_GSHIN_W |
| | | Sample ID | RI-R6-FT-30-GM | RI-R6-FT-31-GF | RI-R6-FT-31-GM | RI-R7-FT-32-GF | RI-R7-FT-32-GM | RI-R7-FT-33-GF | RI-R7-FT-33-GM | RI-R7-FT-34-GF |
| | | Sample Date | 1/7/2015 | 12/29/2014 | 1/8/2015 | 12/29/2014 | 1/15/2015 | 12/22/2014 | 1/12/2015 | 12/22/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.00048 | 0.00135 | 0.00120 | 0.001643734 | 0.001027 | 0.0010461 | 0.000300615 | 0.00051179 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.00049 | 0.00069 | 0.00098 | 0.000929902 | 0.0009078 | 0.0005545 | 0.000303035 | 0.0002342 |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 487 | 502 | 375 | 404.1775 | 287.5561 | 225.4396 | 190.01 | 174.1679 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.5 | 4.4 | 2 | 4.8 | 0.83 | 4 | 1.4 | 1.9 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.09 J | 0.21 U | 0.094 J | 0.062 U | 0.1 | 0.26 | 0.059 J | 0.018 U |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.023 U | 0.0078 J | 0.018 U | 0.0085 J | 0.013 U | 0.017 J | 0.0069 U |
| Copper | 7440-50-8 | mg/kg | 0.49 | 1.8 | 0.66 | 1.4 | 0.69 | 1.7 | 0.59 | 0.77 |
| Lead | 7439-92-1 | mg/kg | 0.059 J | 1 | 0.23 | 0.71 | 0.14 | 1.1 | 0.16 | 0.24 |
| Nickel | 7440-02-0 | mg/kg | 0.23 | 0.86 | 0.4 | 0.75 | 0.38 | 0.82 | 0.22 | 0.31 |
| Selenium | 7782-49-2 | mg/kg | 0.35 J | 0.38 J | 0.32 J | 0.26 U | 0.26 U | 0.24 U | 0.34 J | 0.2 U |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0046 J | 0.0039 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 17 | 41 | 25 | 33 | 24 | 34 | 27 | 36 |
| Mercury | 7439-97-6 | mg/kg | 0.019 J | 0.043 J | 0.036 U | 0.046 J | 0.053 U | 0.01 U | 0.035 U | 0.014 J |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 7.9 J | 7.9 J | 7.1 J | 6 J | 3.7 J | 12 J | 2.7 J | 4.8 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 24 | 15 | 19 | 12 | 13 | 17 | 9 | 12 |
| 4,4'-DDT | 50-29-3 | ug/kg | 3 J | 3.1 J | 1.7 J | 2.8 J | 2.3 J | 2.2 J | 1.5 J | 0.82 J |
| ALDRIN | 309-00-2 | ug/kg | 2.3 J | 2.8 J | 1.8 J | 1.4 J | 0.75 J | 1.2 J | 0.57 J | 0.81 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 200 | 250 | 160 | 190 | 96 | 240 | 88 | 110 |
| DIELDRIN | 60-57-1 | ug/kg | 9.7 | 15 | 9.2 | 14 | 5.7 | 17 | 5.8 | 7.4 |
| ENDRIN | 72-20-8 | ug/kg | 10 | 6.4 J | 4.5 J | 4.6 J | 3.7 J | 3.6 J | 2.3 J | 2.7 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 3.5 | 1.9 J | 1.4 | 1.7 J | 1.6 J | 1.1 J | 1.6 J | 5.2 |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 6 J | 9.9 J | 6.1 J | 8.9 J | 3.4 J | 9.3 J | 3.1 J | 4 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | | 20 | 13 U | 13 U | 13 U | 20 U | 13 U | 20 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | | 36 | 11 U | 40 | 99 | 16 | 11 U | 16 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-34 | FT-35 | FT-35 | FT-36 | FT-36 | FT-37 | FT-37 | FT-38 |
| | | Matrix | TA_SUN_W | TA_GSHIN_W | TA_SUN_W | TA_MOS_W | TA_SUN_W | TA_SUN_W | TA_SUN_W | TA_MIN_W |
| | | Sample ID | RI-R7-FT-34-GM | RI-R7-FT-35-GF | RI-R7-FT-35-GM | RI-R7-FT-36-GF | RI-R7-FT-36-GM | RI-R7-FT-37-GF | RI-R7-FT-37-GM | RI-R7-FT-38-GF |
| | | Sample Date | 1/8/2015 | 12/22/2014 | 1/7/2015 | 12/22/2014 | 1/12/2015 | 12/22/2014 | 1/8/2015 | 12/22/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.0004734 | 0.00019251 | 0.00052234 | 0.00053652 | 0.000328067 | 0.000457 | 0.00027247 | 0.0004202 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.0004734 | 0.0001971 | 0.00052302 | 0.000326 | 0.000330371 | 0.000268 | 0.000247 | 0.0002646 |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 541.8187 | 125.242 | 241.4487 | 131.9918 | 161.7669 | 157.1465 | 128.6375 | 215.8248 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 0.76 | 1.6 | 0.56 | 1.5 | 0.6 | 2.7 | 1.9 | 3.3 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.093 J | 0.017 U | 0.11 | 0.048 J | 0.12 | 0.15 | 0.26 | 0.068 J |
| Cadmium | 7440-43-9 | mg/kg | 0.0068 J | 0.0067 U | 0.029 J | 0.0068 U | 0.017 J | 0.0088 U | 0.015 J | 0.0086 U |
| Copper | 7440-50-8 | mg/kg | 0.49 | 0.8 | 0.81 | 0.97 | 0.59 | 1 | 0.76 | 1.2 |
| Lead | 7439-92-1 | mg/kg | 0.13 | 0.11 | 0.15 | 0.11 | 0.17 | 0.37 | 0.11 | 0.23 |
| Nickel | 7440-02-0 | mg/kg | 0.36 | 0.13 U | 0.27 | 0.22 | 0.2 | 0.46 | 0.19 | 0.67 |
| Selenium | 7782-49-2 | mg/kg | 0.24 J | 0.31 U | 0.22 J | 0.31 U | 0.23 U | 0.27 U | 0.33 J | 0.31 U |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0037 U | 0.0039 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0038 U | 0.0039 U |
| Zinc | 7440-66-6 | mg/kg | 25 | 32 | 25 | 33 | 27 | 32 | 29 | 33 |
| Mercury | 7439-97-6 | mg/kg | 0.071 U | 0.023 J | 0.067 U | 0.026 J | 0.052 U | 0.016 J | 0.042 U | 0.011 U |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 4.2 J | 4 J | 1.7 J | 5.5 J | 1.4 J | 5.7 J | 1.5 J | 6.7 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 16 | 9 | 9.5 | 14 | 5.1 | 13 | 4.8 | 14 |
| 4,4'-DDT | 50-29-3 | ug/kg | 28 | 1.2 J | 2 J | 2 J | 0.93 J | 2.3 J | 0.85 J | 2 J |
| ALDRIN | 309-00-2 | ug/kg | 1.1 J | 0.41 J | 0.17 J | 0.47 J | 0.31 J | 0.68 J | 0.13 J | 0.77 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 99 | 100 | 0.18 U | 150 | 52 | 200 | 73 | 210 |
| DIELDRIN | 60-57-1 | ug/kg | 6 | 8.1 | 3.6 | 11 | 3.3 | 15 | 5.9 | 15 |
| ENDRIN | 72-20-8 | ug/kg | 5.9 J | 2.4 J | 3 J | 3.7 J | 1.5 J | 3.7 J | 1.4 J | 3 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 3.4 | 5.2 J | 1.9 | 5.8 J | 1.8 J | 2.2 J | 0.94 J | 2.6 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 3.3 J | 4.1 J | 1.5 J | 6 J | 1.9 J | 8.3 J | 3.2 J | 8.2 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | 20 U | 34 | 20 U | 13 U | 20 U | 13 U | 20 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 U | 16 U | 11 U | 16 U | 11 U | 16 U | 6.4 | 16 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 3**
**Analytical Data - Fish Tissue Data - Food Web Model**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-38 | FT-39 | FT-39 | FT-40 | FT-40 | FT-41 | FT-41 | FT-42 |
| | | Matrix | TA_SUN_W | TA_BK_W | TA_SUN_W | TA_SUN_W | TA_SUN_W | TA_BK_W | TA_SUN_W | TA_MIN_W |
| | | Sample ID | RI-R7-FT-38-GM | RI-R7-FT-39-GF | RI-R7-FT-39-GM | RI-R7-FT-40-GF | RI-R7-FT-40-GM | RI-R7-FT-41-GF | RI-R7-FT-41-GM | RI-R7-FT-42-GF |
| | | Sample Date | 1/8/2015 | 1/8/2015 | 1/7/2015 | 12/22/2014 | 1/19/2015 | 12/22/2014 | 1/8/2015 | 12/22/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.0004844 | 0.00024542 | 0.000172 | 8.7E-05 | 8.93E-05 | 0.000186 | 0.000194 | 0.000513 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.00041326 | 0.0001946 | 0.000172 | 8.7E-05 | 8.93E-05 | 0.000186 | 0.000194 | 0.000216 |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 165.5928 | 105.1563 | 106.1994 | 91.6741 | 102.6657 | 92.1449 | 135.3492 | 146.515 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.9 | 1.8 | 0.95 | 1.6 | 0.95 | 1.8 | 1.8 | 2 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.077 J | 0.018 U | 0.16 | 0.064 J | 0.16 | 0.14 J | 0.075 J | 0.26 |
| Cadmium | 7440-43-9 | mg/kg | 0.01 J | 0.0071 U | 0.007 U | 0.0074 U | 0.015 J | 0.013 U | 0.01 J | 0.02 U |
| Copper | 7440-50-8 | mg/kg | 0.53 | 1.2 | 0.59 | 1.4 | 0.63 | 1.45 | 0.85 | 1.3 |
| Lead | 7439-92-1 | mg/kg | 0.097 J | 0.12 | 0.19 | 0.13 | 0.19 | 0.28 | 0.23 | 0.19 |
| Nickel | 7440-02-0 | mg/kg | 0.15 | 0.3 | 0.42 | 0.38 | 0.56 | 0.31 | 0.67 | 0.19 |
| Selenium | 7782-49-2 | mg/kg | 0.31 J | 0.32 J | 0.28 J | 0.27 U | 0.47 J | 0.33 U | 0.33 J | 0.34 U |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0039 U | 0.0039 U | 0.0038 U | 0.0039 U | 0.00475 J | 0.0038 U | 0.004 U |
| Zinc | 7440-66-6 | mg/kg | 25 | 33 | 29 | 34 | 33 | 36.5 | 32 | 37 |
| Mercury | 7439-97-6 | mg/kg | 0.05 U | 0.027 U | 0.041 | 0.017 J | 0.048 J | 0.0135 J | 0.036 U | 0.019 J |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 2.8 J | 2 J | 2 J | 2.9 J | 1.3 J | 15 | 1.3 J | 3 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 6.9 | 5 | 7.2 | 5.3 | 3.1 | 11 | 3.4 | 9.4 |
| 4,4'-DDT | 50-29-3 | ug/kg | 0.87 J | 0.83 J | 1.1 J | 0.87 J | 0.76 J | 2.3 J | 0.92 J | 2.1 J |
| ALDRIN | 309-00-2 | ug/kg | 0.33 J | 0.16 J | 0.14 J | 0.17 J | 0.19 U | 0.93 J | 0.11 J | 0.32 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 100 | 75 | 73 | 92 | 48 | 160 | 48 | 140 |
| DIELDRIN | 60-57-1 | ug/kg | 7.9 | 6 | 7.5 | 8.4 | 5.3 | 13.5 | 5.1 | 14 |
| ENDRIN | 72-20-8 | ug/kg | 1.8 J | 1.6 J | 1.9 J | 2.9 J | 1.3 J | 4.8 J | 1.4 J | 2.9 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 1.2 J | 1.8 J | 0.9 J | 1.4 J | 1.4 J | 1.95 J | 1.3 J | 1.3 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 4.4 J | 3.4 J | 3.4 J | 3.8 J | 2.9 J | 6.25 J | 2.6 J | 6.2 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | 20 U | 13 U | 20 U | 13 U | 20 U | 13 U | 20 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 | 16 U | 10 U | 16 U | 11 U | 16 U | 10 U | 16 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 3**
**Analytical Data - Fish Tissue Data - Food Web Model**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-42 | FT-43 | FT-43 | FT-44 | FT-44 | FT-45 | FT-45 | FT-46 |
| | | Matrix | TA_SUN_W | TA_SSHIN_W | TA_SUN_W | TA_BK_W | TA_SUN_W | TA_GSHIN_W | TA_SUN_W | TA_MUM_W |
| | | Sample ID | RI-R7-FT-42-GM | RI-R7-FT-43-GF | RI-R7-FT-43-GM | RI-R7-FT-44-GF | RI-R7-FT-44-GM | RI-R7-FT-45-GF | RI-R7-FT-45-GM | RI-R7-FT-46-GF |
| | | Sample Date | 1/12/2015 | 12/22/2014 | 1/12/2015 | 12/22/2014 | 1/8/2015 | 12/22/2014 | 1/15/2015 | 12/22/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 2.5E-07 | 0.0004 | 0.001174968 | 0.000186 | 0.00034439 | 0.00023 | 0.00041956 | 0.000154 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 7.5E-07 | 0.000202 | 0.001009204 | 0.000186 | 0.000311 | 0.00023 | 0.0002813 | 0.000154 |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 162.7878 | 122.369 | 163.2742 | 96.4979 | 204.6683 | 130.2255 | 120.5235 | 72.8245 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1 | 3 | 1.9 | 1.7 | 1.1 | 1.6 | 1.9 | 2.2 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.14 | 0.045 J | 0.1 | 0.018 U | 0.18 | 0.17 | 0.27 J | 0.018 U |
| Cadmium | 7440-43-9 | mg/kg | 0.012 J | 0.0068 U | 0.013 J | 0.0069 U | 0.031 J | 0.11 U | 0.021 J | 0.039 U |
| Copper | 7440-50-8 | mg/kg | 0.92 | 1.1 | 0.57 | 0.89 | 0.87 | 0.65 | 0.575 | 1.8 |
| Lead | 7439-92-1 | mg/kg | 0.16 | 0.1 | 0.14 | 0.071 J | 0.21 | 0.086 J | 0.195 | 0.18 |
| Nickel | 7440-02-0 | mg/kg | 0.24 | 0.25 | 0.22 | 0.1 U | 0.72 | 0.47 | 0.14 | 0.23 |
| Selenium | 7782-49-2 | mg/kg | 0.34 J | 0.32 U | 0.33 J | 0.3 U | 0.38 J | 0.33 U | 0.33 J | 0.38 U |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0042 J |
| Zinc | 7440-66-6 | mg/kg | 32 | 35 | 28 | 34 | 31 | 30 | 27.5 | 39 |
| Mercury | 7439-97-6 | mg/kg | 0.068 U | 0.02 J | 0.043 U | 0.029 J | 0.052 U | 0.019 J | 0.054 U | 0.041 |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 2.9 J | 3.7 J | 3.4 J | 2.6 J | 2.6 J | 4.4 J | 4.75 J | 1.1 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 7.6 | 8.5 | 10 | 7.2 | 8.4 | 11 | 12.5 | 3.9 |
| 4,4'-DDT | 50-29-3 | ug/kg | 1.2 J | 1.2 J | 2.7 J | 1.4 J | 1.1 J | 1.4 J | 4.15 J | 0.34 J |
| ALDRIN | 309-00-2 | ug/kg | 0.39 J | 0.58 J | 0.31 J | 0.49 J | 0.47 J | 0.49 J | 0.14 J | 0.12 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 84 | 120 | 110 | 100 | 54 | 120 | 145 | 61 |
| DIELDRIN | 60-57-1 | ug/kg | 6.5 | 13 | 11 | 11 | 4 | 16 | 15.5 | 9.4 |
| ENDRIN | 72-20-8 | ug/kg | 1.9 J | 2.2 J | 2.4 J | 2.3 J | 2.6 J | 3.6 | 2.55 J | 1.3 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 1.3 J | 2.5 J | 2.4 | 2.5 J | 1.2 J | 4.2 J | 2.9 J | 2.2 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 4.1 J | 7.5 J | 10 | 6 J | 2.3 J | 7.7 J | 13.5 | 4 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | 20 U | 13 U | 16 | 13 U | 20 U | 13 U | 20 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 U | 16 U | 10 U | 16 U | 11 U | 16 U | 11 U | 16 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 3**
**Analytical Data - Fish Tissue Data - Food Web Model**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream |
|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-46 | FT-07 | FT-07 | FT-08 | FT-08 | FT-09 | FT-09 |
| | | Matrix | TA_SUN_W | TA_SSHIN_W | TA_YP_W | TA_BK_W | TA_YP_W | TA_SSHIN_W | TA_YP_W |
| | | Sample ID | RI-R7-FT-46-GM | RI-R1-FT-07-GF | RI-R1-FT-07-GM | RI-R1-FT-08-GF | RI-R1-FT-08-GM | RI-R1-FT-09-GF | RI-R1-FT-09-GM |
| | | Sample Date | 1/12/2015 | 1/19/2015 | 1/20/2015 | 1/5/2015 | 1/15/2015 | 1/5/2015 | 1/5/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.000251255 | 0.00072699 | 0.0010121 | 0.00064414 | 0.00331719 | 0.0006012 | 0.0028795 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.000256145 | 0.00035127 | 0.000264 | 0.00025582 | 0.001438 | 0.0002706 | 0.001494 |
| **PCBs** | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 159.3133 | 174.3306 | 274.0449 | 178.1143 | 414.9931 | 260.1573 | 550.8623 |
| **Other** | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.2 | 1.3 | 1.2 | 2.3 | 0.93 | 2.9 | 1.6 |
| **Metals** | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.15 | 0.35 | 0.12 | 0.23 | 0.092 J | 0.24 | 0.077 J |
| Cadmium | 7440-43-9 | mg/kg | 0.086 J | 0.0067 U | 0.0071 U | 0.0082 J | 0.0068 U | 0.0086 J | 0.007 U |
| Copper | 7440-50-8 | mg/kg | 0.79 | 0.79 | 0.43 | 1.4 | 0.55 | 1.5 | 0.75 |
| Lead | 7439-92-1 | mg/kg | 0.4 | 0.15 | 0.058 J | 0.89 | 0.091 J | 1.4 | 0.15 |
| Nickel | 7440-02-0 | mg/kg | 0.95 | 0.61 | 0.25 | 0.33 | 0.17 | 0.56 | 0.17 |
| Selenium | 7782-49-2 | mg/kg | 0.5 | 0.33 U | 0.24 U | 0.32 J | 0.27 U | 0.31 J | 0.27 J |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0038 U | 0.0039 U | 0.004 U | 0.0038 U | 0.004 J | 0.0039 U |
| Zinc | 7440-66-6 | mg/kg | 33 | 38 | 25 | 42 | 24 | 38 | 26 |
| Mercury | 7439-97-6 | mg/kg | 0.082 U | 0.047 U | 0.054 U | 0.011 U | 0.055 U | 0.016 J | 0.033 |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 0.055 U | 2.6 J | 3 J | 3.9 J | 7.1 J | 5.2 J | 12 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 6.8 | 13 | 12 | 11 | 22 | 18 | 34 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2 J | 1.2 J | 1.2 J | 1.8 J | 3.4 J | 2.1 J | 2.6 J |
| ALDRIN | 309-00-2 | ug/kg | 0.096 J | 0.61 J | 0.81 J | 0.89 J | 1.6 J | 0.98 J | 2.5 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 74 | 64 | 69 | 62 | 100 | 110 | 180 |
| DIELDRIN | 60-57-1 | ug/kg | 6.3 | 2.3 J | 2.4 | 3.7 | 3.9 | 5.5 | 7.6 |
| ENDRIN | 72-20-8 | ug/kg | 2.3 J | 4.7 | 2.4 J | 2.4 J | 4.4 J | 3.8 J | 7.5 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 1.2 J | 1.3 J | 0.72 J | 3.7 | 0.49 J | 1.3 | 0.9 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 3 J | 3.5 J | 1.2 J | 1.2 J | 1.9 J | 1.6 J | 3.5 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | | 13 U | 13 U | 13 U | 13 U | 13 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 U | | 11 U | 10 U | 110 | 11 U | 11 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 3**
**Analytical Data - Fish Tissue Data - Food Web Model**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream |
|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-10 | FT-10 | FT-11 | FT-11 | FT-11 | FT-12 | FT-12 |
| | | Matrix | TA_SUN_W | TA_YP_W | TA_GSHIN_W | TA_SUN_W | TA_YP_W | TA_SSHIN_W | TA_SUN_W |
| | | Sample ID | RI-R1-FT-10-GF | RI-R1-FT-10-GM | RI-R3-FT-11-GF | RI-R3-FT-11-GM-B | RI-R3-FT-11-GM-A | RI-R3-FT-12-GF | RI-R3-FT-12-GM |
| | | Sample Date | 1/5/2015 | 1/5/2015 | 1/5/2015 | 1/8/2015 | 1/5/2015 | 12/30/2014 | 1/7/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | |
| **Dioxins/Furans** | | | | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.000469 | 0.00242185 | 0.000483 | 0.0008588 | 0.0019663 | 0.000621392 | 0.0004904 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.000469 | 0.0011377 | 0.000276 | 0.000866 | 0.0011285 | 0.000390386 | 0.00048382 |
| **PCBs** | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 328.9568 | 338.978 | 238.1897 | 363.3831 | 442.9609 | 207.2028 | 490.4126 |
| **Other** | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.6 | 1.3 | 1.8 | 0.61 | 1.2 | 2.2 | 1.4 |
| **Metals** | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.13 | 0.13 | 0.19 | 0.017 U | 0.018 J | 0.13 U | 0.05 J |
| Cadmium | 7440-43-9 | mg/kg | 0.0071 J | 0.0069 U | 0.007 J | 0.0089 J | 0.0068 U | 0.0069 U | 0.0069 U |
| Copper | 7440-50-8 | mg/kg | 1.2 | 0.74 | 1.2 | 0.49 | 1.4 | 0.81 | 0.65 |
| Lead | 7439-92-1 | mg/kg | 0.16 | 0.079 J | 0.32 | 0.14 | 0.2 | 0.12 U | 0.25 |
| Nickel | 7440-02-0 | mg/kg | 0.23 | 0.11 | 0.36 | 0.22 | 0.25 | 0.16 | 0.24 |
| Selenium | 7782-49-2 | mg/kg | 0.3 J | 0.21 J | 0.29 J | 0.27 J | 0.3 J | 0.29 J | 0.31 J |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0038 U | 0.0038 U | 0.0037 U | 0.0038 U | 0.0038 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 31 | 23 | 32 | 21 | 24 | 33 | 25 |
| Mercury | 7439-97-6 | mg/kg | 0.024 J | 0.04 | 0.011 U | 0.035 U | 0.025 J | 0.047 U | 0.03 J |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 6.4 J | 6.1 J | 4.7 J | 5.1 J | 11 J | 6.5 J | 8.2 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 22 | 21 | 14 | 21 | 30 | 20 | 33 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2.1 J | 2.1 J | 1 J | 2.3 J | 2.7 J | 1.8 J | 3.3 J |
| ALDRIN | 309-00-2 | ug/kg | 1.4 J | 1.5 J | 1 J | 1.2 J | 1.7 J | 0.94 J | 2.2 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 98 | 130 | 100 | 82 | 180 | 140 | 150 |
| DIELDRIN | 60-57-1 | ug/kg | 5.1 | 5.4 | 4.5 | 3.6 | 6.8 | 7.6 | 6.8 |
| ENDRIN | 72-20-8 | ug/kg | 4.5 J | 4.6 J | 4.3 | 4.5 J | 6.1 J | 6.2 | 7.1 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 1.7 J | 1.8 | 1.4 | 1.1 J | 0.71 J | 1.2 J | 1.2 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 2.3 J | 2.4 J | 1.6 J | 1.6 J | 2.8 J | 2.4 J | 2.7 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 U | 11 U | 11 | 11 U | 11 U | 13 | 11 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 3**
**Analytical Data - Fish Tissue Data - Food Web Model**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Downstream | Downstream | Downstream | Downstream |
|---|---|---|---|---|---|---|
| | | Location ID | FT-13 | FT-13 | FT-14 | FT-14 |
| | | Matrix | TA_SSHIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W |
| | | Sample ID | RI-R3-FT-13-GF | RI-R3-FT-13-GM | RI-R3-FT-14-GF | RI-R3-FT-14-GM |
| | | Sample Date | 1/5/2015 | 1/7/2015 | 12/30/2014 | 1/7/2015 |
| **Chemical** | **CAS** | **Units** | | | | |
| **Dioxins/Furans** | | | | | | |
| TCDD-TEQ (Bird) | RA_TCDD-TEQ_BIR | ug/kg | 0.00059 | 0.000351 | 0.00078255 | 0.00043252 |
| TCDD-TEQ (Mammal) | RA_TCDD-TEQ_MAM | ug/kg | 0.000392 | 0.000351 | 0.00038745 | 0.00043356 |
| **PCBs** | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 363.123 | 313.1695 | 334.46 | 301.7129 |
| **Other** | | | | | | |
| LIPIDS | LIPIDS | % | 2.8 | 1.5 | 1.4 | 1 |
| **Metals** | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.28 | 0.2 | 0.045 U | 0.073 J |
| Cadmium | 7440-43-9 | mg/kg | 0.0087 J | 0.0094 J | 0.007 U | 0.013 J |
| Copper | 7440-50-8 | mg/kg | 1.1 | 1.8 | 0.75 | 0.74 |
| Lead | 7439-92-1 | mg/kg | 0.42 | 0.2 | 0.21 | 0.26 |
| Nickel | 7440-02-0 | mg/kg | 0.32 | 0.31 | 0.3 | 0.37 J |
| Selenium | 7782-49-2 | mg/kg | 0.21 J | 0.3 J | 0.25 U | 0.26 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0038 U | 0.0039 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 33 | 25 | 35 | 27 |
| Mercury | 7439-97-6 | mg/kg | 0.011 U | 0.029 J | 0.13 J | 0.029 J |
| **Pesticides** | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 7.9 J | 2.6 J | 8.2 J | 6.4 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 23 | 10 | 22 | 23 |
| 4,4'-DDT | 50-29-3 | ug/kg | 1.6 J | 1 J | 1.5 J | 2.2 J |
| ALDRIN | 309-00-2 | ug/kg | 1.6 J | 0.52 J | 1.5 J | 1.2 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 110 | 51 | 110 | 100 |
| DIELDRIN | 60-57-1 | ug/kg | 4.7 | 2.8 | 6.4 | 5.8 |
| ENDRIN | 72-20-8 | ug/kg | 5.2 J | 3.1 | 5.3 J | 4.9 J |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 1.6 | 1 | 1.6 J | 1.2 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 2.4 J | 1.1 J | 2.8 J | 2.6 J |
| **Semi-volatile Organic Compounds** | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | 13 U | 13 U | 13 U | 13 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | 11 U | 11 U | 11 U | 11 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 4**
**Analytical Data - Benthic Data**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | KL-08 | KL-LKL-01 | KL-LKL-09 | KL-UKL-04 | R4-FW-17 | R4-FW-22 | R5-FW-18 | R5-FW-19 | R6-01 |
| | | Matrix | TA_CRAYFSH | TA_SNAIL | TA_CLAM | TA_SNAIL | TA_CLAM | TA_SNAIL | TA_SNAIL | TA_CLAM | TA_CRAYFSH |
| | | Sample ID | P2-KL-08-CT | P2-KL-LKL-01-BIT | P2-KL-LKL-09-BIT | P2-KL-UKL-04-BIT | P2-R4-FW-17-BIT | P2-R4-FW-22-BIT | P2-R5-FW-18-BIT | P2-R5-FW-19-BIT | P2-R6-01-CT |
| | | Sample Date | 8/18/2016 | 6/2/2016 | 6/22/2016 | 6/6/2016 | 6/15/2016 | 6/22/2016 | 6/16/2016 | 6/16/2016 | 8/17/2016 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | |
| **PCBs** | | | | | | | | | | | |
| Total PCBs (Aroclors) | RA_TOT_AROCLOR | ug/kg | 74 | 91 | 226 | 57 | 48 | 8.9 | 10.5 | 44 | 24 |
| **Other** | | | | | | | | | | | |
| TOTAL ORGANIC CARBON | TOC | mg/kg | | 72500 | 98000 | 96000 J | 86000 | 73000 | 69000 | 80000 | |
| Percent Moisture | MOIST | % | | 79.8 | 84.2 | 80.5 | 84.6 | 78 | 76.2 | 87.8 | |
| Percent Solids | SOLID | % | | 20.2 | 15.8 | 19.5 | 15.4 | 22 | 23.8 | 12.2 | |
| **Metals** | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.44 | 0.66 | 0.78 J | 0.84 | 0.87 | 1.1 | 0.8 | 0.7 | 0.32 |
| Cadmium | 7440-43-9 | mg/kg | 0.02 J | 0.0505 J | 0.12 | 0.066 J | 0.13 | 0.1 | 0.066 J | 0.11 | 0.017 J |
| Copper | 7440-50-8 | mg/kg | 25 | 53.5 | 9.2 | 51 | 15 | 110 | 62 | 11 | 39 |
| Lead | 7439-92-1 | mg/kg | 0.32 J | 2.7 | 0.47 | 2.7 | 0.28 J+ | 4.8 | 3.6 | 0.44 | 0.41 J |
| Nickel | 7440-02-0 | mg/kg | 0.55 | 1.3 | 0.88 | 2.5 | 0.7 | 3.3 | 2.4 | 0.82 | 0.51 |
| Selenium | 7782-49-2 | mg/kg | 0.14 J | 0.4 J | 0.46 U | 0.54 | 0.43 J | 0.69 | 0.5 | 0.45 | 0.15 J |
| Silver | 7440-22-4 | mg/kg | 0.12 | 0.65 | 0.037 J | 0.32 | 0.071 J | 1 | 0.34 | 0.036 J | 0.11 |
| Zinc | 7440-66-6 | mg/kg | 17 J | 70 | 27 | 56 | 23 | 89 | 57 | 22 | 27 J |
| Mercury | 7439-97-6 | mg/kg | U | 0.05 U | 0.035 U | 0.031 U | 0.045 J | 0.054 J | 0.041 J | 0.035 U | U |
| **Pesticides** | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | | 2.5 J | 3.7 J | 1.2 | 1.5 J | 0.52 J | 0.92 | 1.2 J | U |
| 4,4'-DDE | 72-55-9 | ug/kg | | 5 | 9.4 | 2.5 | 3.6 | 1.2 | 1.3 | 3 | 3.4 |
| 4,4'-DDT | 50-29-3 | ug/kg | | 2.3 J | 4 | 0.23 J | 0.43 J | 0.13 J | 0.12 J | 0.43 J | U |
| ALDRIN | 309-00-2 | ug/kg | | 0.074 U | 0.11 U | 0.075 U | 0.14 U | 0.043 U | 0.074 U | 0.074 U | U |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | | 9.6 | 84 | 0.18 U | 33 J | 8.3 J | 6.7 J | 30 | U |
| DIELDRIN | 60-57-1 | ug/kg | | 1 | 2.6 | 0.74 J | 0.96 J | 0.34 J | 0.32 J | 1.6 | 1.2 |
| ENDRIN | 72-20-8 | ug/kg | | 0.79 J | 2.4 J | 0.61 J | 1.1 J | 0.23 J | 0.27 J | 1.3 J | U |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | | 1.2 | 4.8 | 1 | 1.2 | 0.15 J | 0.14 J | 0.93 | 0.67 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | | 37.1 | 11 U | 119 | 11 U | 11 U | 11 U | 11 U | |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | | 9.2 | 8.4 U | 8.5 | 8.5 U | 8.4 U | 8.4 U | 8.4 U | |
| Total PAHs | RA_TOT_PAH | ug/kg | | 46.3 | 11 U | 127.5 | 11 U | 11 U | 11 U | 11 U | |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
ng/kg - Nanogram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

# Attachment A Table 4
# Analytical Data - Benthic Data
# Benning Road Facility RI/FS Project
# 3400 Benning Rd, N.E., Washington DC 20019

| | | Location Group | Site | Site | Site | Site |
|---|---|---|---|---|---|---|
| | | Location ID | R6-02 | R6-FW-02 | R6-FW-03 | R6-FW-08 |
| | | Matrix | TA_CRAYFSH | TA_SNAIL | TA_SNAIL | TA_CLAM |
| | | Sample ID | P2-R6-02-CT | P2-R6-FW-02-BIT | P2-R6-FW-03-BIT | P2-R6-FW-08-BIT |
| | | Sample Date | 8/18/2016 | 6/3/2016 | 6/3/2016 | 6/7/2016 |
| **Chemical** | **CAS** | **Units** | | | | |
| **PCBs** | | | | | | |
| Total PCBs (Aroclors) | RA_TOT_AROCLOR | ug/kg | 19 | 23 | 118 | 52 |
| **Other** | | | | | | |
| TOTAL ORGANIC CARBON | TOC | mg/kg | | 94000 | 78000 J | 91000 |
| Percent Moisture | MOIST | % | 75.4 | 80.1 | 79.2 | 85.2 |
| Percent Solids | SOLID | % | 24.6 | 19.9 | 20.8 | 14.8 |
| **Metals** | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.84 | 0.64 | 0.7 | 0.79 |
| Cadmium | 7440-43-9 | mg/kg | 0.051 J | 0.059 J | 0.069 J | 0.12 |
| Copper | 7440-50-8 | mg/kg | 33 | 64 | 110 | 12 |
| Lead | 7439-92-1 | mg/kg | 1.2 J | 2 | 2.5 | 0.26 |
| Nickel | 7440-02-0 | mg/kg | 0.93 | 1.9 | 1.5 | 0.91 |
| Selenium | 7782-49-2 | mg/kg | 0.26 J | 0.57 | 0.57 | 0.42 J |
| Silver | 7440-22-4 | mg/kg | 0.1 | 0.4 | 0.58 | 0.05 J |
| Zinc | 7440-66-6 | mg/kg | 28 J | 80 | 68 | 26 |
| Mercury | 7439-97-6 | mg/kg | U | 0.053 J | 0.032 U | 0.072 J |
| **Pesticides** | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | U | 0.38 J | 1.8 | 2.9 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 1.7 J | 0.87 J | 2.5 | 5.4 |
| 4,4'-DDT | 50-29-3 | ug/kg | U | 0.062 U | 0.06 U | 0.84 J |
| ALDRIN | 309-00-2 | ug/kg | U | 0.14 J | 0.072 U | 0.075 U |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | U | 7.9 | 0.18 U | 41 J |
| DIELDRIN | 60-57-1 | ug/kg | 0.685 J | 0.55 | 1.1 | 2.4 J |
| ENDRIN | 72-20-8 | ug/kg | U | 0.5 U | 0.57 J | 2.1 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 0.465 J | 0.88 | 0.79 | 2.4 J |
| **Semi-volatile Organic Compounds** | | | | | | |
| Total HMW PAHs | RA_TOT_PAH_HMW | ug/kg | | 270 | 56 | 11 U |
| Total LMW PAHs | RA_TOT_PAH_LMW | ug/kg | | 23.1 | 8.4 U | 8.4 U |
| Total PAHs | RA_TOT_PAH | ug/kg | | 293.1 | 56 | 11 U |

Notes:

CALC - Calculated value.

CAS - Chemical Abstracts Service.

J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.

mg/kg - Milligram per kilogram.

ng/kg - Nanogram per kilogram.

PAH - Polycyclic aromatic hydrocarbons.

PCBs - Polychlorinated biphenyls.

TEQ - Toxic Equivalence.

U - Not detected.

ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
| | | Location ID | FT-15 | FT-15 | FT-15 | FT-16 | FT-16 | FT-16 | FT-17 | FT-17 | FT-17 | FT-18 |
| | | Matrix | TA_GSHIN_W | TA_LMB_W | TA_SUN_W | TA_LMB_W | TA_SSHIN_W | TA_SUN_W | TA_BC_W | TA_SSHIN_W | TA_SUN_W | TA_LMB_W |
| | | Sample ID | RI-R4-FT-15-GF | RI-R4-FT-15-GT | RI-R4-FT-15-GM | RI-KL-FT-16-GT | RI-KL-FT-16-GF | RI-KL-FT-16-GM | RI-R4-FT-17-GT | RI-R4-FT-17-GF | RI-R4-FT-17-GM | RI-KL-FT-18-GT |
| | | Sample Date | 12/30/2014 | 1/25/2015 | 12/30/2014 | 1/14/2015 | 12/30/2014 | 1/15/2015 | 1/25/2015 | 12/30/2014 | 1/15/2015 | 1/19/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 323.2305 | 748.0105 | 416.5757 | 454.1309 | 289.6285 | 367.5727 | 1737.668 | 320.648 | 434.6088 | 431.8496 |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 2.3 | 2.1 | 1.35 | 0.73 | 2.4 | 1.1 | 4.3 | 2.5 | 1.4 | 1.1 |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.078 U | 0.14 U | 0.19 U | 0.063 J | 0.039 U | 0.088 J | 0.34 | 0.19 U | 0.053 J | 0.018 U |
| Cadmium | 7440-43-9 | mg/kg | 0.0092 U | 0.0069 U | 0.008 U | 0.0067 U | 0.0068 U | 0.014 J | 0.0069 U | 0.0069 U | 0.0074 J | 0.007 U |
| Copper | 7440-50-8 | mg/kg | 1.5 | 0.47 | 0.585 | 0.62 | 0.68 | 0.61 | 0.31 | 1 | 0.68 | 0.43 |
| Lead | 7439-92-1 | mg/kg | 0.57 | 0.021 U | 0.23 | 0.051 J | 0.13 U | 0.27 | 0.036 U | 0.23 | 0.2 | 0.35 |
| Nickel | 7440-02-0 | mg/kg | 1.3 J | 0.2 J | 0.47 | 0.19 | 0.16 | 0.36 | 0.023 U | 0.51 | 0.24 | 0.12 U |
| Selenium | 7782-49-2 | mg/kg | 0.325 J | 0.37 J | 0.43 J | 0.35 J | 0.29 J | 0.31 J | 0.41 J | 0.36 J | 0.38 J | 0.34 U |
| Silver | 7440-22-4 | mg/kg | 0.0083 U | 0.0039 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0039 U |
| Zinc | 7440-66-6 | mg/kg | 37.5 | 16 | 29.5 | 18 | 39 | 28 | 19 | 33 | 25 | 17 |
| Mercury | 7439-97-6 | mg/kg | 0.057 J | 0.063 J | 0.065 J | 0.13 J | 0.069 J | 0.052 U | 0.18 | 0.05 J | 0.055 U | 0.058 U |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 8.6 J | 12 J | 6.35 J | 3.1 J | 8.2 J | 4.2 J | 37 J | 8 J | 6.6 J | 7.4 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 17.5 | 33 | 18 | 19 | 19 | 14 | 130 | 16 | 24 | 24 |
| 4,4'-DDT | 50-29-3 | ug/kg | 1.6 J | 4.2 J | 1.8 J | 21 | 1.4 J | 0.87 J | 8.9 J | 1 J | 2.4 J | 15 |
| ALDRIN | 309-00-2 | ug/kg | 2.5 J | 2.6 J | 1.3 J | 1.1 J | 1.1 J | 0.98 J | 8 | 1.6 J | 1.6 J | 1.7 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 140 | 200 | 99 | 80 | 130 | 71 | 570 | 130 | 110 | 130 |
| DIELDRIN | 60-57-1 | ug/kg | 8.5 | 7.2 | 4.8 | 2 | 6.3 | 2.7 | 21 | 6.6 | 5.5 | 4.3 |
| ENDRIN | 72-20-8 | ug/kg | 5.8 J | 7.95 J | 4.75 J | 5.6 J | 5.4 J | 3.5 J | 18 J | 4.1 J | 4.8 J | 5.5 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 4.8 J | 5.1 J | 2.45 J | 1.5 J | 3.2 J | 1.8 J | 13 J | 3.4 J | 3.3 J | 2.7 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 13 U | | 13 U | 13 U | 13 U | 13 U | 22 | 13 U | 13 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-18 | FT-18 | FT-19 | FT-19 | FT-19 | FT-20 | FT-20 | FT-20 | FT-21 | FT-21 |
| | | Matrix | TA_MIN_W | TA_SUN_W | TA_LMB_W | TA_SSHIN_W | TA_SUN_W | TA_BK_W | TA_LMB_W | TA_SUN_W | TA_GSHIN_W | TA_LMB_W |
| | | Sample ID | RI-KL-FT-18-GF | RI-KL-FT-18-GM | RI-R5-FT-19-GT | RI-R5-FT-19-GF | RI-R5-FT-19-GM | RI-KL-FT-20-GF | RI-KL-FT-20-GT | RI-KL-FT-20-GM | RI-KL-FT-21-GF | RI-KL-FT-21-GT |
| | | Sample Date | 12/30/2014 | 1/19/2015 | 1/15/2015 | 12/30/2014 | 1/7/2015 | 1/20/2015 | 1/23/2015 | 1/8/2015 | 12/29/2014 | 1/13/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 333.8623 | 365.1652 | 406.3095 | 321.0156 | 300.1359 | 300.2637 | 462.352 | 303.8433 | 293.524 | 656.1861 |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 2.6 | 0.84 | 0.71 | 3.4 | 0.82 | 1.3 | 0.85 | 1.1 | 2.6 | 2.9 |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.21 U | 0.018 U | 0.023 J | 0.03 U | 0.24 | 0.27 | 0.15 U | 0.12 | 0.15 U | 0.12 |
| Cadmium | 7440-43-9 | mg/kg | 0.0068 U | 0.022 J | 0.0068 U | 0.0071 U | 0.007 U | 0.0069 U | 0.007 U | 0.0069 U | 0.0069 U | 0.0069 U |
| Copper | 7440-50-8 | mg/kg | 1.2 | 0.63 | 0.58 | 0.97 | 0.52 | 0.9 | 0.48 | 0.62 | 1.2 | 0.42 |
| Lead | 7439-92-1 | mg/kg | 0.82 | 0.32 | 0.077 J | 0.43 | 0.13 | 0.62 | 0.04 U | 1 | 0.83 | 0.053 J |
| Nickel | 7440-02-0 | mg/kg | 0.45 | 0.24 | 0.12 | 0.34 | 0.21 | 0.42 | 0.12 | 0.35 | 1.2 | 0.24 |
| Selenium | 7782-49-2 | mg/kg | 0.25 U | 0.43 J | 0.29 J | 0.31 J | 0.31 J | 0.34 U | 0.3 J | 0.32 J | 0.24 U | 0.35 J |
| Silver | 7440-22-4 | mg/kg | 0.005 J | 0.0053 U | 0.0038 U | 0.0039 U | 0.0039 U | 0.0039 U | 0.0039 U | 0.0039 U | 0.0057 J | 0.0039 U |
| Zinc | 7440-66-6 | mg/kg | 29 | 26 | 21 | 37 | 28 | 37 | 17 | 29 | 31 | 17 |
| Mercury | 7439-97-6 | mg/kg | 0.046 U | 0.051 U | 0.051 J | 0.065 J | 0.019 J | 0.042 U | 0.051 U | 0.013 U | 0.047 U | 0.057 U |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 7.8 J | 3.3 J | 5.5 J | 10 J | 5.5 J | 6.1 J | 6.3 J | 3.5 J | 7.7 J | 14 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 23 | 14 | 25 | 23 | 17 | 17 | 24 | 14 | 18 | 33 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2.3 J | 1.6 J | 3.3 J | 2.4 J | 1.3 J | 0.95 J | 0.98 J | 1.1 J | 1.6 J | 2 J |
| ALDRIN | 309-00-2 | ug/kg | 1.4 J | 1.1 J | 1.3 J | 1.7 J | 0.95 J | 0.96 J | 1.4 J | 0.7 J | 1.3 J | 2.3 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 140 | 75 | 120 | 220 | 96 | 77 | 100 | 49 | 130 | 240 |
| DIELDRIN | 60-57-1 | ug/kg | 6.5 | 1.9 J | 4.5 | 13 | 4.7 | 3.4 | 3 | 1.6 J | 5.9 | 12 |
| ENDRIN | 72-20-8 | ug/kg | 5.4 J | 3.2 J | 6.7 J | 6.5 J | 4.5 J | 3.7 J | 5.2 J | 3.4 J | 5.3 J | 6.4 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 2.5 J | 1.6 J | 3.1 J | 6.5 J | 2.4 J | 1.5 J | 8.2 | 1.3 J | 2.7 J | 7.7 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 8.7 | 13 U | 110 | 29 | 13 U | 13 U | | 13 U | 8.6 | 13 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-21 | FT-22 | FT-22 | FT-22 | FT-23 | FT-23 | FT-24 | FT-24 | FT-24 | FT-25 |
| | | Matrix | TA_SUN_W | TA_LMB_W | TA_MIN_W | TA_SUN_W | TA_SSHIN_W | TA_SUN_W | TA_LMB_W | TA_SSHIN_W | TA_SUN_W | TA_LMB_W |
| | | Sample ID | RI-KL-FT-21-GM | RI-R5-FT-22-GT | RI-R5-FT-22-GF | RI-R5-FT-22-GM | RI-KL-FT-23-GF | RI-KL-FT-23-GM | RI-KL-FT-24-GT | RI-KL-FT-24-GF | RI-KL-FT-24-GM | RI-KL-FT-25-GT |
| | | Sample Date | 12/30/2014 | 1/14/2015 | 1/19/2015 | 1/15/2015 | 1/15/2015 | 1/7/2015 | 1/19/2015 | 1/20/2015 | 1/19/2015 | 1/23/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 258.739 | 581.0669 | 361.7959 | 384.8505 | 307.5317 | 199.3382 | 399.1326 | 354.1327 | 261.034 | |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.3 | 0.64 | 2.4 | 1.2 | 1.9 | 0.6 | 1.3 | 3.5 | 1.9 | |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.047 U | 0.2 | 0.071 J | 0.13 | 0.12 | 0.029 J | 0.11 | 0.2 | 0.38 | 0.065 U |
| Cadmium | 7440-43-9 | mg/kg | 0.013 U | 0.059 J | 0.013 J | 0.0069 U | 0.017 J | 0.0068 U | 0.0069 U | 0.011 J | 0.0069 U | 0.0067 U |
| Copper | 7440-50-8 | mg/kg | 0.74 | 0.49 | 1.5 | 0.635 | 1.4 | 0.49 | 0.48 | 1.3 | 0.57 | 0.6 |
| Lead | 7439-92-1 | mg/kg | 0.23 | 0.042 J | 1.1 | 0.19 | 0.89 | 0.15 | 0.034 J | 0.9 | 0.22 | 0.029 U |
| Nickel | 7440-02-0 | mg/kg | 0.12 | 0.63 | 0.75 | 0.22 | 0.68 | 0.63 J | 0.19 U | 0.72 | 0.22 | 0.043 U |
| Selenium | 7782-49-2 | mg/kg | 0.25 U | 0.29 J | 0.4 J | 0.425 J | 0.35 J | 0.29 J | 0.26 U | 0.37 J | 0.35 U | 0.37 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0038 U | 0.0094 U | 0.0038 U | 0.0047 U | 0.0038 U | 0.0038 U | 0.0057 U | 0.0038 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 28 | 21 | 42 | 30 | 36 | 31 | 17 | 37 | 25 | 19 |
| Mercury | 7439-97-6 | mg/kg | 0.078 J | 0.67 | 0.056 U | 0.053 U | 0.054 U | 0.045 | 0.04 U | 0.045 U | 0.053 U | |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 5.1 J | 3.9 J | 9.6 J | 4.3 J | 6 J | 2.2 J | 9.9 J | 2.2 J | 5.6 J | 5.6 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 18 | 23 | 18 | 12.5 | 14 | 12 | 32 | 10 | 14 | 24 |
| 4,4'-DDT | 50-29-3 | ug/kg | 0.87 J | 5.1 J | 1.7 J | 1.7 J | 1.2 J | 9.1 | 18 | 0.82 J | 9 | 15 |
| ALDRIN | 309-00-2 | ug/kg | 1.1 J | 0.74 J | 1.3 J | 0.925 J | 0.94 J | 0.42 J | 1.7 J | 0.95 J | 0.91 J | 1.1 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 81 | 140 | 150 | 85 | 110 | 39 | 160 | 42 | 94 | 82 |
| DIELDRIN | 60-57-1 | ug/kg | 3.6 J | 8.5 | 6.5 | 4.3 | 4 | 0.07 U | 5.6 | 2.3 | 4 | 3 |
| ENDRIN | 72-20-8 | ug/kg | 5.3 J | 5.9 J | 3.6 J | 3.6 J | 4.1 J | 3 J | 6.7 J | 1.6 J | 3.4 J | 5.2 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 2.1 J | 4.2 J | 3.7 J | 2.2 J | 2.7 J | 1 J | 3.5 J | 5.3 J | 2.4 J | 1.8 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 13 U | 13 U | 13 U | 11 | 13 U | | 13 U | 13 U | |

Notes:

CALC - Calculated value.

CAS - Chemical Abstracts Service.

J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.

mg/kg - Milligram per kilogram.

PAH - Polycyclic aromatic hydrocarbons.

PCBs - Polychlorinated biphenyls.

TEQ - Toxic Equivalence.

U - Not detected.

ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-25 | FT-25 | FT-26 | FT-27 | FT-27 | FT-27 | FT-28 | FT-28 | FT-28 | FT-29 |
| | | Matrix | TA_MIN_W | TA_SUN_W | TA_MIN_W | TA_LMB_W | TA_MIN_W | TA_SUN_W | TA_LMB_W | TA_SSHIN_W | TA_SUN_W | TA_LMB_W |
| | | Sample ID | RI-KL-FT-25-GF | RI-KL-FT-25-GM | RI-KL-FT-26-GF | RI-KL-FT-27-GT | RI-KL-FT-27-GF | RI-KL-FT-27-GM | RI-R6-FT-28-GT | RI-R6-FT-28-GF | RI-R6-FT-28-GM | RI-R6-FT-29-GT |
| | | Sample Date | 12/29/2014 | 1/12/2015 | 1/5/2015 | 1/13/2015 | 1/23/2015 | 1/25/2015 | 1/13/2015 | 12/29/2014 | 1/20/2015 | 1/14/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 340.7957 | | 394.7758 | 615.4247 | 395.8164 | 275.6489 | 864.571 | 284.0147 | 389.9849 | 495.5634 |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 3.4 | | 3.5 | 1 | 3.4 | 0.96 | 2.6 | 2.3 | 1.1 | 0.51 |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.17 U | | 0.19 | 0.018 U | 0.25 U | 0.16 U | 0.062 J | 0.098 U | 0.094 J | 0.17 |
| Cadmium | 7440-43-9 | mg/kg | 0.01 U | | 0.027 J | 0.021 J | 0.02 J | 0.0069 U | 0.0071 J | 0.016 U | 0.015 J | 0.0067 U |
| Copper | 7440-50-8 | mg/kg | 1.3 | | 1.9 | 0.59 | 2 | 0.51 | 0.73 | 1.2 | 0.51 | 0.47 |
| Lead | 7439-92-1 | mg/kg | 0.68 | | 1.5 | 0.039 J | 1.5 | 0.2 | 0.11 | 0.51 | 0.17 | 0.036 J |
| Nickel | 7440-02-0 | mg/kg | 0.86 | | 1.1 J | 0.68 | 1.1 | 0.14 | 0.7 | 0.75 | 0.43 | 0.53 |
| Selenium | 7782-49-2 | mg/kg | 0.34 J | | 0.37 J | 0.3 J | 0.41 J | 0.44 J | 0.33 J | 0.22 U | 0.32 U | 0.34 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | | 0.0081 J | 0.0039 U | 0.0054 J | 0.0038 U | 0.0038 U | 0.0039 U | 0.0038 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 37 | | 41 | 16 | 37 | 26 | 17 | 31 | 24 | 17 |
| Mercury | 7439-97-6 | mg/kg | 0.045 J | 0.034 U | 0.011 U | 0.19 U | 0.052 U | 0.054 U | 0.11 U | 0.086 J | 0.04 U | 0.14 J |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 11 J | 3.3 J | 9.9 J | 8.4 J | 10 J | 5.3 J | 10 J | 6.5 J | 5.5 J | 2.4 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 19 | 9.9 | 20 | 29 | 19 | 12 | 42 | 12 | 16 | 21 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2.2 J | 12 | 2.6 J | 4.8 J | 3.5 J | 1.9 J | 5.6 J | 1.9 J | 1.5 J | 3.2 J |
| ALDRIN | 309-00-2 | ug/kg | 1.8 J | 0.4 J | 1.7 J | 1.6 J | 1.6 J | 0.99 J | 2.1 J | 1.3 J | 1.2 J | 0.95 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 190 | 55 | 200 | 130 | 210 | 89 | 190 | 130 | 120 | 86 |
| DIELDRIN | 60-57-1 | ug/kg | 9.5 | 2.1 J | 10 | 4.9 | 10 | 4.2 | 10 | 7.8 | 6.5 | 3.3 |
| ENDRIN | 72-20-8 | ug/kg | 5.8 J | 3.7 J | 5.3 J | 8.3 J | 5.4 J | 3.8 J | 12 J | 4.4 J | 4.6 J | 5.6 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 5.7 J | 1.3 J | 6.2 J | 3.3 J | 5.2 J | 2.8 J | 7.6 J | 4.5 J | 4.2 J | 1.9 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 26 | | 13 U | 13 U | 160 | 22 | 6.6 | 19 | 12 | 13 U |

Notes:

CALC - Calculated value.

CAS - Chemical Abstracts Service.

J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.

mg/kg - Milligram per kilogram.

PAH - Polycyclic aromatic hydrocarbons.

PCBs - Polychlorinated biphenyls.

TEQ - Toxic Equivalence.

U - Not detected.

ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Site | Site | Site | Site | Site | Site | Site | Site | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-29 | FT-29 | FT-30 | FT-30 | FT-30 | FT-31 | FT-31 | FT-31 | FT-32 | FT-32 |
| | | Matrix | TA_SSHIN_W | TA_SUN_W | TA_LMB_W | TA_MIN_W | TA_SUN_W | TA_LMB_W | TA_MIN_W | TA_SUN_W | TA_MIN_W | TA_NS_W |
| | | Sample ID | RI-R6-FT-29-GF | RI-R6-FT-29-GM | RI-R6-FT-30-GT | RI-R6-FT-30-GF | RI-R6-FT-30-GM | RI-R6-FT-31-GT | RI-R6-FT-31-GF | RI-R6-FT-31-GM | RI-R7-FT-32-GF | RI-R7-FT-32-GT |
| | | Sample Date | 1/20/2015 | 1/8/2015 | 1/23/2015 | 12/29/2014 | 1/7/2015 | 1/8/2015 | 12/29/2014 | 1/8/2015 | 12/29/2014 | 1/20/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | | | |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 262.5206 | 232.5082 | | 438.305 | 486.9611 | 133.5008 | 502.2224 | 374.77 | 404.1775 | 523.336 |
| **Other** | | | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.8 | 1.2 | 1 | 4.3 | 1.5 | 1.1 | 4.4 | 2 | 4.8 | 2.9 |
| **Metals** | | | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.22 | 0.067 J | 0.12 U | 0.14 U | 0.09 J | 0.11 | 0.21 U | 0.094 J | 0.062 U | 0.068 J |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.022 J | 0.0068 U | 0.0088 U | 0.0069 U | 0.0067 U | 0.023 U | 0.0078 J | 0.018 U | 0.0068 U |
| Copper | 7440-50-8 | mg/kg | 1.2 | 0.62 | 0.38 | 1.2 | 0.49 | 0.45 | 1.8 | 0.66 | 1.4 | 0.58 |
| Lead | 7439-92-1 | mg/kg | 0.35 | 0.17 | 0.035 U | 0.46 | 0.059 J | 0.03 J | 1 | 0.23 | 0.71 | 0.026 U |
| Nickel | 7440-02-0 | mg/kg | 0.4 | 0.41 | 0.061 U | 0.79 | 0.23 | 0.16 | 0.86 | 0.4 | 0.75 | 0.23 |
| Selenium | 7782-49-2 | mg/kg | 0.42 J | 0.36 J | 0.27 J | 0.34 J | 0.35 J | 0.34 J | 0.38 J | 0.32 J | 0.26 U | 0.33 U |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 44 | 25 | 19 | 36 | 17 | 17 | 41 | 25 | 33 | 15 |
| Mercury | 7439-97-6 | mg/kg | 0.041 U | 0.035 U | | 0.041 U | 0.019 J | 0.19 | 0.043 J | 0.036 U | 0.046 J | 0.052 U |
| **Pesticides** | | | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 3.8 J | 2 J | 1.9 J | 9.3 J | 7.9 J | 1.3 J | 7.9 J | 7.1 J | 6 J | 10 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 9.8 | 7.3 | 7.2 | 17 | 24 | 4.5 | 15 | 19 | 12 | 32 |
| 4,4'-DDT | 50-29-3 | ug/kg | 1.4 J | 1.3 J | 6.2 | 1.8 J | 3 J | 1.2 J | 3.1 J | 1.7 J | 2.8 J | 16 |
| ALDRIN | 309-00-2 | ug/kg | 0.85 J | 0.58 J | 0.68 J | 2.4 J | 2.3 J | 0.32 J | 2.8 J | 1.8 J | 1.4 J | 1.2 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 110 | 51 | 55 | 190 | 200 | 98 | 250 | 160 | 190 | 120 |
| DIELDRIN | 60-57-1 | ug/kg | 6.5 | 3.4 | 2.5 | 11 | 9.7 | 5.6 | 15 | 9.2 | 14 | 8.9 |
| ENDRIN | 72-20-8 | ug/kg | 3.1 J | 2.5 J | 2.2 J | 5.5 J | 10 | 1.3 J | 6.4 J | 4.5 J | 4.6 J | 3.8 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 4 J | 2.1 J | 1.7 J | 7.6 J | 6 J | 3 J | 9.9 J | 6.1 J | 8.9 J | 5.7 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 13 U | | 40 | | 13 U | 56 | 13 U | 40 | 13 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-32 | FT-33 | FT-33 | FT-33 | FT-34 | FT-34 | FT-34 | FT-35 |
| | | Matrix | TA_SUN_W | TA_LMB_W | TA_MIN_W | TA_SUN_W | TA_GSHIN_W | TA_LMB_W | TA_SUN_W | TA_GSHIN_W |
| | | Sample ID | RI-R7-FT-32-GM | RI-R7-FT-33-GT | RI-R7-FT-33-GF | RI-R7-FT-33-GM | RI-R7-FT-34-GF | RI-R7-FT-34-GT | RI-R7-FT-34-GM | RI-R7-FT-35-GF |
| | | Sample Date | 1/15/2015 | 1/7/2015 | 12/22/2014 | 1/12/2015 | 12/22/2014 | 1/13/2015 | 1/8/2015 | 12/22/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 287.5561 | 134.2953 | 225.4396 | 190.01 | 174.1679 | 966.474 | 541.8187 | 125.242 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 0.83 | 1.9 | 4 | 1.4 | 1.9 | 3.7 | 0.76 | 1.6 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.1 | 0.045 J | 0.26 | 0.059 J | 0.018 U | 0.1 | 0.093 J | 0.017 U |
| Cadmium | 7440-43-9 | mg/kg | 0.0085 J | 0.0086 J | 0.013 U | 0.017 J | 0.0069 U | 0.007 U | 0.0068 J | 0.0067 U |
| Copper | 7440-50-8 | mg/kg | 0.69 | 0.4 | 1.7 | 0.59 | 0.77 | 0.48 | 0.49 | 0.8 |
| Lead | 7439-92-1 | mg/kg | 0.14 | 0.024 J | 1.1 | 0.16 | 0.24 | 0.027 J | 0.13 | 0.11 |
| Nickel | 7440-02-0 | mg/kg | 0.38 | 0.12 | 0.82 | 0.22 | 0.31 | 0.37 | 0.36 | 0.13 U |
| Selenium | 7782-49-2 | mg/kg | 0.26 U | 0.31 J | 0.24 U | 0.34 J | 0.2 U | 0.27 U | 0.24 J | 0.31 U |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0039 U | 0.0046 J | 0.0039 U | 0.0038 U | 0.0039 U | 0.0038 U | 0.0037 U |
| Zinc | 7440-66-6 | mg/kg | 24 | 13 | 34 | 27 | 36 | 14 J | 25 | 32 |
| Mercury | 7439-97-6 | mg/kg | 0.053 U | 0.13 | 0.01 U | 0.035 U | 0.014 J | 0.14 U | 0.071 U | 0.023 J |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 3.7 J | 2 J | 12 J | 2.7 J | 4.8 J | 19 J | 4.2 J | 4 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 13 | 9.7 | 17 | 9 | 12 | 43 | 16 | 9 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2.3 J | 1.7 J | 2.2 J | 1.5 J | 0.82 J | 6.8 J | 28 | 1.2 J |
| ALDRIN | 309-00-2 | ug/kg | 0.75 J | 0.51 J | 1.2 J | 0.57 J | 0.81 J | 3.2 J | 1.1 J | 0.41 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 96 | 86 | 240 | 88 | 110 | 380 | 99 | 100 |
| DIELDRIN | 60-57-1 | ug/kg | 5.7 | 7.4 | 17 | 5.8 | 7.4 | 22 | 6 | 8.1 |
| ENDRIN | 72-20-8 | ug/kg | 3.7 J | 2 J | 3.6 J | 2.3 J | 2.7 J | 11 J | 5.9 J | 2.4 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 3.4 J | 3.9 J | 9.3 J | 3.1 J | 4 J | 20 | 3.3 J | 4.1 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 99 | 13 U | 16 | 13 U | 20 U | 6.5 | 13 U | 20 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-35 | FT-35 | FT-36 | FT-36 | FT-36 | FT-37 | FT-37 | FT-37 |
| | | Matrix | TA_LMB_W | TA_SUN_W | TA_LMB_W | TA_MOS_W | TA_SUN_W | TA_SMB_W | TA_SUN_W | TA_SUN_W |
| | | Sample ID | RI-R7-FT-35-GT | RI-R7-FT-35-GM | RI-R7-FT-36-GT | RI-R7-FT-36-GF | RI-R7-FT-36-GM | RI-R7-FT-37-GT | RI-R7-FT-37-GF | RI-R7-FT-37-GM |
| | | Sample Date | 1/14/2015 | 1/7/2015 | 1/23/2015 | 12/22/2014 | 1/12/2015 | 1/7/2015 | 12/22/2014 | 1/8/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 447.1396 | 241.4487 | 311.7785 | 131.9918 | 161.7669 | 179.6309 | 157.1465 | 128.6375 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.4 | 0.56 | 1.5 | 1.5 | 0.6 | 2.1 | 2.7 | 1.9 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.1 | 0.11 | 0.14 U | 0.048 J | 0.12 | 0.083 J | 0.15 | 0.26 |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.029 J | 0.007 U | 0.0068 U | 0.017 J | 0.007 U | 0.0088 U | 0.015 J |
| Copper | 7440-50-8 | mg/kg | 0.35 | 0.81 | 0.38 | 0.97 | 0.59 | 0.43 | 1 | 0.76 |
| Lead | 7439-92-1 | mg/kg | 0.015 U | 0.15 | 0.026 U | 0.11 | 0.17 | 0.023 J | 0.37 | 0.11 |
| Nickel | 7440-02-0 | mg/kg | 0.57 | 0.27 | 0.033 U | 0.22 | 0.2 | 0.25 | 0.46 | 0.19 |
| Selenium | 7782-49-2 | mg/kg | 0.29 J | 0.22 J | 0.32 J | 0.31 U | 0.23 U | 0.31 J | 0.27 U | 0.33 J |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0039 U | 0.0039 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0039 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 15 | 25 | 17 | 33 | 27 | 16 | 32 | 29 |
| Mercury | 7439-97-6 | mg/kg | 0.12 J | 0.067 U | 0.052 U | 0.026 J | 0.052 U | 0.16 | 0.016 J | 0.042 U |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 5.4 J | 1.7 J | 3.6 J | 5.5 J | 1.4 J | 0.054 U | 5.7 J | 1.5 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 16 | 9.5 | 8.7 | 14 | 5.1 | 20 | 13 | 4.8 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2.9 J | 2 J | 0.77 J | 2 J | 0.93 J | 3.8 J | 2.3 J | 0.85 J |
| ALDRIN | 309-00-2 | ug/kg | 0.74 J | 0.17 J | 1 J | 0.47 J | 0.31 J | 0.28 J | 0.68 J | 0.13 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 170 | 0.18 U | 75 | 150 | 52 | 280 | 200 | 73 |
| DIELDRIN | 60-57-1 | ug/kg | 9.1 | 3.6 | 3.4 | 11 | 3.3 | 22 | 15 | 5.9 |
| ENDRIN | 72-20-8 | ug/kg | 4.1 J | 3 J | 2.3 J | 3.7 J | 1.5 J | 4.9 | 3.7 J | 1.4 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 5.3 J | 1.5 J | 2.6 J | 6 J | 1.9 J | 25 | 8.3 J | 3.2 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 34 | 20 U | 20 U | 13 U | 13 U | 20 U | 6.4 |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-38 | FT-38 | FT-38 | FT-39 | FT-39 | FT-39 | FT-40 | FT-40 |
| | | Matrix | TA_LMB_W | TA_MIN_W | TA_SUN_W | TA_BK_W | TA_LMB_W | TA_SUN_W | TA_LMB_W | TA_SUN_W |
| | | Sample ID | RI-R7-FT-38-GT | RI-R7-FT-38-GF | RI-R7-FT-38-GM | RI-R7-FT-39-GF | RI-R7-FT-39-GT | RI-R7-FT-39-GM | RI-R7-FT-40-GT | RI-R7-FT-40-GF |
| | | Sample Date | 1/13/2015 | 12/22/2014 | 1/8/2015 | 1/8/2015 | 1/19/2015 | 1/7/2015 | 1/23/2015 | 12/22/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 475.9551 | 215.8248 | 165.5928 | 105.1563 | 333.152 | 106.1994 | | 91.6741 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 2.3 | 3.3 | 1.9 | 1.8 | 1.1 | 0.95 | 1.2 | 1.6 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.018 U | 0.068 J | 0.077 J | 0.018 U | 0.16 | 0.16 | 0.11 U | 0.064 J |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.0086 U | 0.01 J | 0.0071 U | 0.0069 U | 0.007 U | 0.0068 U | 0.0074 U |
| Copper | 7440-50-8 | mg/kg | 0.46 | 1.2 | 0.53 | 1.2 | 0.72 | 0.59 | 0.42 | 1.4 |
| Lead | 7439-92-1 | mg/kg | 0.022 J | 0.23 | 0.097 J | 0.12 | 0.021 U | 0.19 | 0.021 U | 0.13 |
| Nickel | 7440-02-0 | mg/kg | 0.41 | 0.67 | 0.15 | 0.3 | 0.17 U | 0.42 | 0.093 J | 0.38 |
| Selenium | 7782-49-2 | mg/kg | 0.34 J | 0.31 U | 0.31 J | 0.32 J | 0.45 J | 0.28 J | 0.28 J | 0.27 U |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.0039 U | 0.0039 U | 0.0039 U | 0.0039 U | 0.0039 U | 0.0038 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 13 | 33 | 25 | 33 | 25 | 29 | 17 | 34 |
| Mercury | 7439-97-6 | mg/kg | 0.18 U | 0.011 U | 0.05 U | 0.027 U | 0.058 U | 0.041 | | 0.017 J |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 2.8 J | 6.7 J | 2.8 J | 2 J | 5.8 J | 2 J | 4.8 J | 2.9 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 15 | 14 | 6.9 | 5 | 18 | 7.2 | 13 | 5.3 |
| 4,4'-DDT | 50-29-3 | ug/kg | 3.1 J | 2 J | 0.87 J | 0.83 J | 1.4 J | 1.1 J | 0.94 J | 0.87 J |
| ALDRIN | 309-00-2 | ug/kg | 0.46 J | 0.77 J | 0.33 J | 0.16 J | 1.2 J | 0.14 J | 1.1 J | 0.17 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 150 | 210 | 100 | 75 | 140 | 73 | 110 | 92 |
| DIELDRIN | 60-57-1 | ug/kg | 10 | 15 | 7.9 | 6 | 7.8 | 7.5 | 4.3 | 8.4 |
| ENDRIN | 72-20-8 | ug/kg | 4.6 J | 3 J | 1.8 J | 1.6 J | 5.1 J | 1.9 J | 4.2 J | 2.9 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 7.1 J | 8.2 J | 4.4 J | 3.4 J | 5.1 J | 3.4 J | 2.8 J | 3.8 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 12 | 20 U | 11 | 20 U | 92 | 13 U | | 20 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-40 | FT-41 | FT-41 | FT-41 | FT-42 | FT-42 | FT-42 | FT-43 |
| | | Matrix | TA_SUN_W | TA_BK_W | TA_LMB_W | TA_SUN_W | TA_LMB_W | TA_MIN_W | TA_SUN_W | TA_LMB_W |
| | | Sample ID | RI-R7-FT-40-GM | RI-R7-FT-41-GF | RI-R7-FT-41-GT | RI-R7-FT-41-GM | RI-R7-FT-42-GT | RI-R7-FT-42-GF | RI-R7-FT-42-GM | RI-R7-FT-43-GT |
| | | Sample Date | 1/19/2015 | 12/22/2014 | 1/8/2015 | 1/8/2015 | 1/14/2015 | 12/22/2014 | 1/12/2015 | 1/6/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 102.6657 | 92.1449 | 319.7748 | 135.3492 | 184.0502 | 146.515 | 162.7878 | |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 0.95 | 1.8 | 1.1 | 1.8 | 0.83 | 2 | 1 | |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.16 | 0.14 J | 0.037 J | 0.075 J | 0.14 | 0.26 | 0.14 | |
| Cadmium | 7440-43-9 | mg/kg | 0.015 J | 0.013 U | 0.0069 U | 0.01 J | 0.0069 U | 0.02 U | 0.012 J | |
| Copper | 7440-50-8 | mg/kg | 0.63 | 1.45 | 0.47 | 0.85 | 0.47 | 1.3 | 0.92 | |
| Lead | 7439-92-1 | mg/kg | 0.19 | 0.28 | 0.018 J | 0.23 | 0.015 U | 0.19 | 0.16 | |
| Nickel | 7440-02-0 | mg/kg | 0.56 | 0.31 | 0.17 | 0.67 | 0.25 | 0.19 | 0.24 | |
| Selenium | 7782-49-2 | mg/kg | 0.47 J | 0.33 U | 0.28 J | 0.33 J | 0.23 U | 0.34 U | 0.34 J | |
| Silver | 7440-22-4 | mg/kg | 0.0039 U | 0.00475 J | 0.0039 U | 0.0038 U | 0.0039 U | 0.004 U | 0.0039 U | |
| Zinc | 7440-66-6 | mg/kg | 33 | 36.5 | 19 | 32 | 22 | 37 | 32 | |
| Mercury | 7439-97-6 | mg/kg | 0.048 J | 0.0135 J | 0.042 U | 0.036 U | 0.057 J | 0.019 J | 0.068 U | |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 1.3 J | 15 | 6.5 J | 1.3 J | 3.2 J | 3 J | 2.9 J | 5.8 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 3.1 | 11 | 21 | 3.4 | 13 | 9.4 | 7.6 | 17 |
| 4,4'-DDT | 50-29-3 | ug/kg | 0.76 J | 2.3 J | 1.8 J | 0.92 J | 2.5 J | 2.1 J | 1.2 J | 2.1 J |
| ALDRIN | 309-00-2 | ug/kg | 0.19 U | 0.93 J | 0.84 J | 0.11 J | 0.41 J | 0.32 J | 0.39 J | 1.3 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 48 | 160 | 110 | 48 | 120 | 140 | 84 | 120 |
| DIELDRIN | 60-57-1 | ug/kg | 5.3 | 13.5 | 4.9 | 5.1 | 8.1 | 14 | 6.5 | 6 |
| ENDRIN | 72-20-8 | ug/kg | 1.3 J | 4.8 J | 4.5 J | 1.4 J | 3.4 J | 2.9 J | 1.9 J | 4.5 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 2.9 J | 6.25 J | 2.9 J | 2.6 J | 4.5 J | 6.2 J | 4.1 J | 3.3 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 20 U | 13 U | 13 U | 13 U | 20 U | 13 U | |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI / FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream | Upstream |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-43 | FT-43 | FT-44 | FT-44 | FT-44 | FT-45 | FT-45 | FT-45 |
| | | Matrix | TA_SSHIN_W | TA_SUN_W | TA_BK_W | TA_LMB_W | TA_SUN_W | TA_GSHIN_W | TA_LMB_W | TA_SUN_W |
| | | Sample ID | RI-R7-FT-43-GF | RI-R7-FT-43-GM | RI-R7-FT-44-GF | RI-R7-FT-44-GT | RI-R7-FT-44-GM | RI-R7-FT-45-GF | RI-R7-FT-45-GT | RI-R7-FT-45-GM |
| | | Sample Date | 12/22/2014 | 1/12/2015 | 12/22/2014 | 1/6/2015 | 1/8/2015 | 12/22/2014 | 1/15/2015 | 1/15/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | | |
| **PCBs** | | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 122.369 | 163.2742 | 96.4979 | 263.8677 | 204.6683 | 130.2255 | 353.844 | 120.5235 |
| **Other** | | | | | | | | | | |
| LIPIDS | LIPIDS | % | 3 | 1.9 | 1.7 | 1.4 | 1.1 | 1.6 | 1.7 | 1.9 |
| **Metals** | | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.045 J | 0.1 | 0.018 U | 0.11 | 0.18 | 0.17 | 0.054 J | 0.27 J |
| Cadmium | 7440-43-9 | mg/kg | 0.0068 U | 0.013 J | 0.0069 U | 0.0069 U | 0.031 J | 0.11 U | 0.007 U | 0.021 J |
| Copper | 7440-50-8 | mg/kg | 1.1 | 0.57 | 0.89 | 0.51 | 0.87 | 0.65 | 0.47 | 0.575 |
| Lead | 7439-92-1 | mg/kg | 0.1 | 0.14 | 0.071 J | 0.019 J | 0.21 | 0.086 J | 0.025 J | 0.195 |
| Nickel | 7440-02-0 | mg/kg | 0.25 | 0.22 | 0.1 U | 0.34 | 0.72 | 0.47 | 0.31 | 0.14 |
| Selenium | 7782-49-2 | mg/kg | 0.32 U | 0.33 J | 0.3 U | 0.25 J | 0.38 J | 0.33 U | 0.31 J | 0.33 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0038 U | 0.0039 U | 0.0039 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0039 U |
| Zinc | 7440-66-6 | mg/kg | 35 | 28 | 34 | 19 | 31 | 30 | 20 | 27.5 |
| Mercury | 7439-97-6 | mg/kg | 0.02 J | 0.043 U | 0.029 J | 0.047 | 0.052 U | 0.019 J | | 0.054 U |
| **Pesticides** | | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 3.7 J | 3.4 J | 2.6 J | 7.2 J | 2.6 J | 4.4 J | 5.1 J | 4.75 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 8.5 | 10 | 7.2 | 20 | 8.4 | 11 | 19 | 12.5 |
| 4,4'-DDT | 50-29-3 | ug/kg | 1.2 J | 2.7 J | 1.4 J | 1.7 J | 1.1 J | 1.4 J | 1.9 J | 4.15 J |
| ALDRIN | 309-00-2 | ug/kg | 0.58 J | 0.31 J | 0.49 J | 1.2 J | 0.47 J | 0.49 J | 1.6 J | 0.14 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 120 | 110 | 100 | 170 | 54 | 120 | 120 | 145 |
| DIELDRIN | 60-57-1 | ug/kg | 13 | 11 | 11 | 8.8 | 4 | 16 | 6.3 | 15.5 |
| ENDRIN | 72-20-8 | ug/kg | 2.2 J | 2.4 J | 2.3 J | 5.1 J | 2.6 J | 3.6 | 4.5 J | 2.55 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 7.5 J | 10 | 6 J | 5.3 J | 2.3 J | 7.7 J | 3.6 J | 13.5 |
| **Semi-volatile Organic Compounds** | | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 20 U | 13 U | 16 | 21 U | 13 U | 20 U | 110 | 13 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Upstream | Upstream | Upstream | Downstream | Downstream | Downstream | Downstream |
|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-46 | FT-46 | FT-46 | FT-07 | FT-07 | FT-07 | FT-08 |
| | | Matrix | TA_LMB_W | TA_MUM_W | TA_SUN_W | TA_LMB_W | TA_SSHIN_W | TA_YP_W | TA_BK_W |
| | | Sample ID | RI-R7-FT-46-GT | RI-R7-FT-46-GF | RI-R7-FT-46-GM | RI-R1-FT-07-GT | RI-R1-FT-07-GF | RI-R1-FT-07-GM | RI-R1-FT-08-GF |
| | | Sample Date | 12/30/2014 | 12/22/2014 | 1/12/2015 | 1/26/2015 | 1/19/2015 | 1/20/2015 | 1/5/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | |
| **PCBs** | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 71.2909 | 72.8245 | 159.3133 | 420.0617 | 174.3306 | 274.0449 | 178.1143 |
| **Other** | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.6 | 2.2 | 1.2 | 0.49 | 1.3 | 1.2 | 2.3 |
| **Metals** | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.018 U | 0.018 U | 0.15 | 0.16 U | 0.35 | 0.12 | 0.23 |
| Cadmium | 7440-43-9 | mg/kg | 0.0068 U | 0.039 U | 0.086 J | 0.0067 U | 0.0067 U | 0.0071 U | 0.0082 J |
| Copper | 7440-50-8 | mg/kg | 0.45 | 1.8 | 0.79 | 0.74 | 0.79 | 0.43 | 1.4 |
| Lead | 7439-92-1 | mg/kg | 0.0083 U | 0.18 | 0.4 | 0.023 U | 0.15 | 0.058 J | 0.89 |
| Nickel | 7440-02-0 | mg/kg | 0.16 | 0.23 | 0.95 | 0.37 | 0.61 | 0.25 | 0.33 |
| Selenium | 7782-49-2 | mg/kg | 0.29 J | 0.38 U | 0.5 | 0.38 J | 0.33 U | 0.24 U | 0.32 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0042 J | 0.0039 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.004 U |
| Zinc | 7440-66-6 | mg/kg | 15 | 39 | 33 | 16 | 38 | 25 | 42 |
| Mercury | 7439-97-6 | mg/kg | 0.3 | 0.041 | 0.082 U | 0.13 J | 0.047 U | 0.054 U | 0.011 U |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 3 J | 1.1 J | 0.055 U | 3.3 J | 2.6 J | 3 J | 3.9 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 9.5 | 3.9 | 6.8 | 18 | 13 | 12 | 11 |
| 4,4'-DDT | 50-29-3 | ug/kg | 1 J | 0.34 J | 2 J | 2.4 J | 1.2 J | 1.2 J | 1.8 J |
| ALDRIN | 309-00-2 | ug/kg | 0.43 J | 0.12 J | 0.096 J | 1.3 J | 0.61 J | 0.81 J | 0.89 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 260 | 61 | 74 | 80 | 64 | 69 | 62 |
| DIELDRIN | 60-57-1 | ug/kg | 15 | 9.4 | 6.3 | 2.5 | 2.3 J | 2.4 | 3.7 |
| ENDRIN | 72-20-8 | ug/kg | 1.4 J | 1.3 J | 2.3 J | 4.4 J | 4.7 | 2.4 J | 2.4 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 20 | 4 J | 3 J | 1.7 J | 3.5 J | 1.2 J | 1.2 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 12 | 20 U | 13 U | 13 U | | 13 U | 13 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream |
|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-08 | FT-08 | FT-09 | FT-09 | FT-09 | FT-10 | FT-10 |
| | | Matrix | TA_LMB_W | TA_YP_W | TA_LMB_W | TA_SSHIN_W | TA_YP_W | TA_LMB_W | TA_SUN_W |
| | | Sample ID | RI-R1-FT-08-GT | RI-R1-FT-08-GM | RI-R1-FT-09-GT | RI-R1-FT-09-GF | RI-R1-FT-09-GM | RI-R1-FT-10-GT | RI-R1-FT-10-GF |
| | | Sample Date | 1/15/2015 | 1/15/2015 | 1/14/2015 | 1/5/2015 | 1/5/2015 | 1/23/2015 | 1/5/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | |
| **PCBs** | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 141.177 | 414.9931 | 456.5772 | 260.1573 | 550.8623 | 552.2362 | 328.9568 |
| **Other** | | | | | | | | | |
| LIPIDS | LIPIDS | % | 2.2 | 0.93 | 2 | 2.9 | 1.6 | 0.95 | 1.6 |
| **Metals** | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.034 J | 0.092 J | 0.24 | 0.24 | 0.077 J | 0.13 U | 0.13 |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.0068 U | 0.0069 U | 0.0086 J | 0.007 U | 0.0069 U | 0.0071 J |
| Copper | 7440-50-8 | mg/kg | 1.1 | 0.55 | 0.52 | 1.5 | 0.75 | 0.57 | 1.2 |
| Lead | 7439-92-1 | mg/kg | 0.035 J | 0.091 J | 0.024 J | 1.4 | 0.15 | 0.026 U | 0.16 |
| Nickel | 7440-02-0 | mg/kg | 0.13 | 0.17 | 0.595 | 0.56 | 0.17 | 0.15 | 0.23 |
| Selenium | 7782-49-2 | mg/kg | 0.2 U | 0.27 U | 0.29 J | 0.31 J | 0.27 J | 0.32 J | 0.3 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0038 U | 0.0039 U | 0.004 J | 0.0039 U | 0.0038 U | 0.0039 U |
| Zinc | 7440-66-6 | mg/kg | 17 | 24 | 17 | 38 | 26 | 19 | 31 |
| Mercury | 7439-97-6 | mg/kg | 0.053 U | 0.055 U | 0.078 J | 0.016 J | 0.033 | 0.085 J | 0.024 J |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 1.4 J | 7.1 J | 6.55 J | 5.2 J | 12 J | 4.1 J | 6.4 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 8.5 | 22 | 22 | 18 | 34 | 18 | 22 |
| 4,4'-DDT | 50-29-3 | ug/kg | 6.2 | 3.4 J | 5.5 J | 2.1 J | 2.6 J | 2.9 J | 2.1 J |
| ALDRIN | 309-00-2 | ug/kg | 0.44 J | 1.6 J | 1.2 J | 0.98 J | 2.5 J | 1.6 J | 1.4 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 27 | 100 | 255 | 110 | 180 | 92 J | 98 |
| DIELDRIN | 60-57-1 | ug/kg | 1.3 | 3.9 | 20 | 5.5 | 7.6 | 3.7 | 5.1 |
| ENDRIN | 72-20-8 | ug/kg | 1.7 J | 4.4 J | 6.3 J | 3.8 J | 7.5 J | 4.4 J | 4.5 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 0.49 J | 1.9 J | 18 J | 1.6 J | 3.5 J | 3.7 J | 2.3 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 110 | 13 U | 13 U | 13 U | 13 U | 13 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream |
|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-10 | FT-11 | FT-11 | FT-11 | FT-11 | FT-12 | FT-12 |
| | | Matrix | TA_YP_W | TA_GSHIN_W | TA_LMB_W | TA_SUN_W | TA_YP_W | TA_SB_W | TA_SSHIN_W |
| | | Sample ID | RI-R1-FT-10-GM | RI-R3-FT-11-GF | RI-R3-FT-11-GT | RI-R3-FT-11-GM-B | RI-R3-FT-11-GM-A | RI-R3-FT-12-GT | RI-R3-FT-12-GF |
| | | Sample Date | 1/5/2015 | 1/5/2015 | 1/13/2015 | 1/8/2015 | 1/5/2015 | 1/13/2015 | 12/30/2014 |
| **Chemical** | **CAS** | **Units** | | | | | | | |
| **PCBs** | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 338.978 | 238.1897 | 1858.546 | 363.3831 | 442.9609 | 1368.5744 | 207.2028 |
| **Other** | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.3 | 1.8 | 2.9 | 0.61 | 1.2 | 2.3 | 2.2 |
| **Metals** | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.13 | 0.19 | 0.13 | 0.017 U | 0.018 J | 0.079 J | 0.13 U |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.007 J | 0.0069 U | 0.0089 J | 0.0068 U | 0.007 U | 0.0069 U |
| Copper | 7440-50-8 | mg/kg | 0.74 | 1.2 | 0.47 | 0.49 | 1.4 | 0.47 | 0.81 |
| Lead | 7439-92-1 | mg/kg | 0.079 J | 0.32 | 0.039 J | 0.14 | 0.2 | 0.024 J | 0.12 U |
| Nickel | 7440-02-0 | mg/kg | 0.11 | 0.36 | 0.38 | 0.22 | 0.25 | 0.98 | 0.16 |
| Selenium | 7782-49-2 | mg/kg | 0.21 J | 0.29 J | 0.4 J | 0.27 J | 0.3 J | 0.36 J | 0.29 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0038 U | 0.0038 U | 0.0037 U | 0.0038 U | 0.0039 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 23 | 32 | 18 | 21 | 24 | 16 | 33 |
| Mercury | 7439-97-6 | mg/kg | 0.04 | 0.011 U | 0.13 U | 0.035 U | 0.025 J | 0.12 U | 0.047 U |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 6.1 J | 4.7 J | 30 J | 5.1 J | 11 J | 19 J | 6.5 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 21 | 14 | 130 | 21 | 30 | 130 | 20 |
| 4,4'-DDT | 50-29-3 | ug/kg | 2.1 J | 1 J | 13 J | 2.3 J | 2.7 J | 11 J | 1.8 J |
| ALDRIN | 309-00-2 | ug/kg | 1.5 J | 1 J | 8 J | 1.2 J | 1.7 J | 3.8 J | 0.94 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 130 | 100 | 430 | 82 | 180 | 360 | 140 |
| DIELDRIN | 60-57-1 | ug/kg | 5.4 | 4.5 | 15 | 3.6 | 6.8 | 16 | 7.6 |
| ENDRIN | 72-20-8 | ug/kg | 4.6 J | 4.3 | 24 J | 4.5 J | 6.1 J | 19 J | 6.2 |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 2.4 J | 1.6 J | 10 J | 1.6 J | 2.8 J | 6.4 J | 2.4 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 11 | 47 | 13 U | 13 U | 13 U | 13 |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

**Attachment A Table 5**
**Analytical Data - Fish Tissue Data - Critical Body Residues**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Location Group | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream | Downstream |
|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | FT-12 | FT-13 | FT-13 | FT-13 | FT-14 | FT-14 | FT-14 |
| | | Matrix | TA_SUN_W | TA_LMB_W | TA_SSHIN_W | TA_SUN_W | TA_LMB_W | TA_SSHIN_W | TA_SUN_W |
| | | Sample ID | RI-R3-FT-12-GM | RI-R3-FT-13-GT | RI-R3-FT-13-GF | RI-R3-FT-13-GM | RI-R3-FT-14-GT | RI-R3-FT-14-GF | RI-R3-FT-14-GM |
| | | Sample Date | 1/7/2015 | 1/13/2015 | 1/5/2015 | 1/7/2015 | 1/14/2015 | 12/30/2014 | 1/7/2015 |
| **Chemical** | **CAS** | **Units** | | | | | | | |
| **PCBs** | | | | | | | | | |
| Total PCBs (Congeners) | RA_TOT_PCB_CONG | ug/kg | 490.4126 | 1483.0495 | 363.123 | 313.1695 | 897.6951 | 334.46 | 301.7129 |
| **Other** | | | | | | | | | |
| LIPIDS | LIPIDS | % | 1.4 | 1.5 | 2.8 | 1.5 | 1.7 | 1.4 | 1 |
| **Metals** | | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 0.05 J | 0.083 J | 0.28 | 0.2 | 0.083 J | 0.045 U | 0.073 J |
| Cadmium | 7440-43-9 | mg/kg | 0.0069 U | 0.0067 U | 0.0087 J | 0.0094 J | 0.007 U | 0.007 U | 0.013 J |
| Copper | 7440-50-8 | mg/kg | 0.65 | 0.39 | 1.1 | 1.8 | 0.41 | 0.75 | 0.74 |
| Lead | 7439-92-1 | mg/kg | 0.25 | 0.049 J | 0.42 | 0.2 | 0.053 J | 0.21 | 0.26 |
| Nickel | 7440-02-0 | mg/kg | 0.24 | 0.25 | 0.32 | 0.31 | 0.44 | 0.3 | 0.37 J |
| Selenium | 7782-49-2 | mg/kg | 0.31 J | 0.31 J | 0.21 J | 0.3 J | 0.32 J | 0.25 U | 0.26 J |
| Silver | 7440-22-4 | mg/kg | 0.0038 U | 0.0038 U | 0.0038 U | 0.0038 U | 0.0039 U | 0.0039 U | 0.0038 U |
| Zinc | 7440-66-6 | mg/kg | 25 | 17 | 33 | 25 | 17 | 35 | 27 |
| Mercury | 7439-97-6 | mg/kg | 0.03 J | 0.13 U | 0.011 U | 0.029 J | 0.089 J | 0.13 J | 0.029 J |
| **Pesticides** | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 8.2 J | 14 J | 7.9 J | 2.6 J | 7.5 J | 8.2 J | 6.4 J |
| 4,4'-DDE | 72-55-9 | ug/kg | 33 | 94 | 23 | 10 | 28 | 22 | 23 |
| 4,4'-DDT | 50-29-3 | ug/kg | 3.3 J | 9.8 J | 1.6 J | 1 J | 3 J | 1.5 J | 2.2 J |
| ALDRIN | 309-00-2 | ug/kg | 2.2 J | 2.8 J | 1.6 J | 0.52 J | 1.6 J | 1.5 J | 1.2 J |
| CHLORDANE (ALL) | CHLORDANE_ALL | ug/kg | 150 | 210 | 110 | 51 | 120 | 110 | 100 |
| DIELDRIN | 60-57-1 | ug/kg | 6.8 | 8.3 | 4.7 | 2.8 | 4.4 | 6.4 | 5.8 |
| ENDRIN | 72-20-8 | ug/kg | 7.1 J | 20 J | 5.2 J | 3.1 | 6.7 J | 5.3 J | 4.9 J |
| HEPTACHLOR EPOXIDE | 1024-57-3 | ug/kg | 2.7 J | 4.6 J | 2.4 J | 1.1 J | 2.9 J | 2.8 J | 2.6 J |
| **Semi-volatile Organic Compounds** | | | | | | | | | |
| Total PAHs | RA_TOT_PAH | ug/kg | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U | 13 U |

Notes:
CALC - Calculated value.
CAS - Chemical Abstracts Service.
J - The chemical was positively identified; however, the
associated numerical value is an estimated concentration.
mg/kg - Milligram per kilogram.
PAH - Polycyclic aromatic hydrocarbons.
PCBs - Polychlorinated biphenyls.
TEQ - Toxic Equivalence.
U - Not detected.
ug/kg - Microgram per kilogram.

# Attachment B

# Summary Statistics of Analytical Data and Exposure Point Concentrations

**Attachment B Table 1**
**Selection of Exposure Point Concentrations - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | CAS | Units | FOD (a) | Minimum (b, e) | Mean (c, e) | Kaplan-Meier Mean (f) | Maximum (d, e) | UCL Selected (e, g) | EPC (e, g, h) |
|---|---|---|---|---|---|---|---|---|---|
| **INORGANICS** | | | | | | | | | |
| Aluminum | 7429-90-5 | mg/kg | 84:84 | 1.90E+03 | 8.42E+03 | -- | 1.80E+04 | 95% Student's-t UCL | 9.04E+03 |
| Antimony | 7440-36-0 | mg/kg | 83:84 | 5.00E-02 | 1.22E+00 | 1.20E+00 | 4.30E+01 | 95% KM (Chebyshev) UCL | 3.41E+00 |
| Arsenic | 7440-38-2 | mg/kg | 84:84 | 7.90E-01 | 4.52E+00 | -- | 1.70E+01 | 95% Approximate Gamma UCL | 5.02E+00 |
| Barium | 7440-39-3 | mg/kg | 84:84 | 1.70E+01 | 8.44E+01 | -- | 1.80E+02 | 95% Student's-t UCL | 8.97E+01 |
| Beryllium | 7440-41-7 | mg/kg | 84:84 | 1.50E-01 | 1.07E+00 | -- | 2.20E+00 | 95% Student's-t UCL | 1.14E+00 |
| Cadmium | 7440-43-9 | mg/kg | 84:84 | 2.40E-01 | 1.20E+00 | -- | 5.20E+00 | 95% Chebyshev (Mean, Sd) UCL | 1.69E+00 |
| Chromium | 7440-47-3 | mg/kg | 84:84 | 1.10E+01 | 3.91E+01 | -- | 1.40E+02 | 95% Approximate Gamma UCL | 4.25E+01 |
| Copper | 7440-50-8 | mg/kg | 84:84 | 9.60E+00 | 5.67E+01 | -- | 2.40E+02 | 95% Chebyshev(Mean, Sd) UCL | 7.45E+01 |
| Cyanide | 57-12-5 | mg/kg | 15:20 | 1.50E-01 | 8.33E-01 | 6.60E-01 | 4.90E+00 | KM H-UCL | 9.91E-01 |
| Iron | 7439-89-6 | mg/kg | 84:84 | 7.50E+03 | 2.09E+04 | -- | 3.40E+04 | 95% Modified-t UCL | 2.21E+04 |
| Lead | 7439-92-1 | mg/kg | 84:84 | 1.10E+01 | 7.60E+01 | -- | 3.20E+02 | 95% Chebyshev(Mean, Sd) UCL | 9.91E+01 |
| Manganese | 7439-96-5 | mg/kg | 84:84 | 8.60E+01 | 2.74E+02 | -- | 5.90E+02 | 95% Approximate Gamma UCL | 2.99E+02 |
| Mercury | 7439-97-6 | mg/kg | 84:84 | 3.30E-02 | 1.97E-01 | -- | 6.90E-01 | 95% Approximate Gamma UCL | 2.18E-01 |
| Nickel | 7440-02-0 | mg/kg | 84:84 | 7.70E+00 | 3.88E+01 | -- | 1.60E+02 | 95% Chebyshev(Mean, Sd) UCL | 5.20E+01 |
| Selenium | 7782-49-2 | mg/kg | 84:84 | 3.40E-02 | 9.30E-01 | -- | 2.75E+00 | 95% Approximate Gamma UCL | 1.04E+00 |
| Silver | 7440-22-4 | mg/kg | 84:84 | 4.40E-02 | 5.19E-01 | -- | 3.50E+00 | 95% Chebyshev(Mean, Sd) UCL | 7.93E-01 |
| Thallium | 7440-28-0 | mg/kg | 84:84 | 3.70E-02 | 2.01E-01 | -- | 6.30E-01 | 95% Approximate Gamma UCL | 2.17E-01 |
| Vanadium | 7440-62-2 | mg/kg | 84:84 | 8.50E+00 | 6.00E+01 | -- | 4.40E+02 | 95% Chebyshev (Mean, Sd) UCL | 9.30E+01 |
| Zinc | 7440-66-6 | mg/kg | 84:84 | 4.60E+01 | 2.23E+02 | -- | 6.30E+02 | 95% Approximate Gamma UCL | 2.44E+02 |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | | | | |
| Aroclor-1248 | 12672-29-6 | mg/kg | 71:84 | 1.50E-02 | 1.80E-01 | 1.49E-01 | 8.90E-01 | KM H-UCL | 4.57E-01 |
| Aroclor-1254 | 11097-69-1 | mg/kg | 21:84 | 1.90E-02 | 1.00E-01 | 2.51E-02 | 2.50E-01 | 95% KM (t) UCL | 3.55E-02 |
| Aroclor-1260 | 11096-82-5 | mg/kg | 83:84 | 3.10E-03 | 1.34E-01 | 1.32E-01 | 1.00E+00 | KM H-UCL | 1.79E-01 |
| PCB, Total Congeners | TOTCONG | mg/kg | 32:32 | 3.80E-02 | 9.05E-01 | -- | 1.18E+01 | 95% Chebyshev (Mean, Sd) UCL | 2.54E+00 |
| PCB, Total Aroclors | TOT-PCB-ARO-C | mg/kg | 83:84 | 3.10E-03 | 3.13E-01 | 3.09E-01 | 1.90E+00 | KM H-UCL | 4.75E-01 |
| **PESTICIDES** | | | | | | | | | |
| 4,4'-DDD | 72-54-8 | mg/kg | 49:49 | 7.60E-04 | 5.90E-03 | -- | 6.80E-02 | 95% Chebyshev(Mean, Sd) UCL | 1.17E-02 |
| 4,4'-DDE | 72-55-9 | mg/kg | 48:49 | 1.40E-03 | 9.61E-03 | 9.44E-03 | 5.60E-02 | KM H-UCL | 1.14E-02 |
| 4,4'-DDT | 50-29-3 | mg/kg | 33:49 | 3.70E-04 | 5.10E-02 | 3.46E-02 | 1.50E+00 | 95% KM (Chebyshev) UCL | 1.69E-01 |
| Aldrin | 309-00-2 | mg/kg | 30:49 | 7.40E-05 | 5.97E-04 | 4.84E-04 | 3.00E-03 | KM H-UCL | 7.60E-04 |
| alpha-BHC | 319-84-6 | mg/kg | 2:49 | 1.30E-04 | 1.90E-04 | 6.95E-05 | 2.40E-04 | Maximum Detected Value | 2.40E-04 |
| beta-BHC | 319-85-7 | mg/kg | 11:49 | 2.90E-04 | 1.13E-03 | 3.77E-04 | 3.90E-03 | 95% GROS Adjusted Gamma UCL | 9.82E-03 |
| Chlordane | CHLORDANE_ALL | mg/kg | 19:20 | 2.20E-02 | 5.90E-02 | 5.63E-02 | 1.30E-01 | 95% KM (t) UCL | 6.78E-02 |
| cis-Chlordane | 5103-71-9 | mg/kg | 29:29 | 1.40E-03 | 7.70E-03 | -- | 1.80E-02 | 95% Student's-t UCL | 9.01E-03 |
| delta-BHC | 319-86-8 | mg/kg | 20:49 | 1.80E-04 | 1.20E-03 | 6.05E-04 | 5.50E-03 | 95% GROS Adjusted Gamma UCL | 8.35E-03 |
| Dieldrin | 60-57-1 | mg/kg | 39:49 | 2.60E-04 | 2.30E-03 | 1.85E-03 | 1.40E-02 | 95% GROS Adjusted Gamma UCL | 4.86E-03 |
| Endosulfan II | 33213-65-9 | mg/kg | 30:49 | 1.80E-04 | 1.40E-03 | 9.89E-04 | 6.80E-03 | 95% GROS Adjusted Gamma UCL | 6.39E-03 |
| Endosulfan Sulfate | 1031-07-8 | mg/kg | 30:48 | 1.70E-04 | 2.11E-03 | 1.45E-03 | 1.10E-02 | Gamma Adjusted KM-UCL | 2.20E-03 |
| Endrin | 72-20-8 | mg/kg | 36:49 | 3.10E-04 | 4.35E-03 | 3.35E-03 | 2.20E-02 | 95% GROS Adjusted Gamma UCL | 7.38E-03 |
| Endrin ketone | 53494-70-5 | mg/kg | 12:28 | 5.20E-04 | 3.00E-03 | 1.60E-03 | 8.00E-03 | 95% KM (t) UCL | 2.20E-03 |
| Chlordane (technical) | 12789-03-6 | mg/kg | 14:15 | 2.20E-02 | 5.70E-02 | 5.27E-02 | 1.30E-01 | 95% KM Adjusted Gamma UCL | 7.14E-02 |
| Gamma-BHC (Lindane) | 58-89-9 | mg/kg | 27:49 | 7.70E-05 | 4.80E-04 | 3.66E-04 | 1.60E-03 | 95% GROS Adjusted Gamma UCL | 6.83E-03 |
| Heptachlor | 76-44-8 | mg/kg | 30:49 | 2.10E-04 | 1.53E-03 | 1.08E-03 | 7.10E-03 | KM H-UCL | 2.57E-03 |
| Heptachlor Epoxide | 1024-57-3 | mg/kg | 46:49 | 1.20E-04 | 1.50E-03 | 1.45E-03 | 6.50E-03 | KM H-UCL | 2.24E-03 |
| Methoxychlor | 72-43-5 | mg/kg | 14:28 | 1.70E-03 | 1.30E-02 | 6.79E-03 | 2.70E-02 | 95% KM (t) UCL | 9.32E-03 |
| trans-Chlordane | 5103-74-2 | mg/kg | 24:29 | 1.90E-03 | 1.00E-02 | 8.36E-03 | 3.10E-02 | 95% KM (Chebyshev) UCL | 1.38E-02 |

**Attachment B Table 1**
**Selection of Exposure Point Concentrations - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | CAS | Units | FOD (a) | Minimum (b, e) | Mean (c, e) | Kaplan-Meier Mean (f) | Maximum (d, e) | UCL Selected (e, g) | EPC (e, g, h) |
|---|---|---|---|---|---|---|---|---|---|
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 13:14 | 9.20E-03 | 3.90E-02 | 3.89E-02 | 8.20E-02 | 95% KM (t) UCL | 5.18E-02 |
| 4-Methylphenol | 106-44-5 | mg/kg | 6:14 | 2.70E-02 | 7.30E-02 | 7.30E-02 | 1.10E-01 | 95% KM (t) UCL | 9.64E-02 |
| Acenaphthene | 83-32-9 | mg/kg | 55:69 | 7.70E-03 | 5.24E-02 | 4.85E-02 | 4.30E-01 | KM H-UCL | 5.70E-02 |
| Acenaphthylene | 208-96-8 | mg/kg | 57:69 | 1.60E-02 | 6.50E-02 | 6.16E-02 | 1.70E-01 | 95% KM (t) UCL | 6.78E-02 |
| Acetophenone | 98-86-2 | mg/kg | 6:14 | 1.50E-02 | 3.10E-02 | 3.10E-02 | 4.40E-02 | 95% KM (t) UCL | 3.84E-02 |
| Anthracene | 120-12-7 | mg/kg | 66:69 | 1.60E-02 | 1.34E-01 | 1.30E-01 | 8.60E-01 | 95% KM (Chebyshev) UCL | 1.87E-01 |
| Benzaldehyde | 100-52-7 | mg/kg | 11:13 | 2.40E-02 | 1.50E-01 | 1.44E-01 | 3.20E-01 | 95% KM (t) UCL | 1.94E-01 |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 68:69 | 2.10E-02 | 5.30E-01 | 5.26E-01 | 2.30E+00 | 95% KM (Chebyshev) UCL | 6.98E-01 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 68:69 | 2.80E-02 | 6.00E-01 | 5.90E-01 | 2.00E+00 | 95% KM (Chebyshev) UCL | 7.56E-01 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 68:69 | 2.90E-02 | 6.49E-01 | 6.40E-01 | 1.70E+00 | 95% GROS Approximate Gamma UCL | 7.23E-01 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 67:69 | 6.60E-02 | 3.32E-01 | 3.22E-01 | 9.60E-01 | 95% GROS Approximate Gamma UCL | 3.60E-01 |
| Benzoic acid | 65-85-0 | mg/kg | 10:20 | 7.50E-01 | 1.10E+00 | 5.70E-01 | 1.40E+00 | 95% KM (t) UCL | 7.77E-01 |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | mg/kg | 34:34 | 2.10E-01 | 1.51E+00 | -- | 1.00E+01 | 95% Chebyshev(Mean, Sd) UCL (j) | 2.75E+00 |
| Butylbenzylphthalate | 85-68-7 | mg/kg | 17:34 | 4.30E-02 | 2.40E-01 | 1.49E-01 | 2.50E+00 | 95% KM (Chebyshev) UCL | 4.67E-01 |
| Caprolactam | 105-60-2 | mg/kg | 1:14 | 3.90E-01 | 3.90E-01 | -- | 3.90E-01 | Maximum Detected Value | 3.90E-01 |
| Carbazole | 86-74-8 | mg/kg | 14:14 | 2.30E-02 | 9.30E-02 | -- | 2.50E-01 | 95% Adjusted Gamma UCL | 1.32E-01 |
| Chrysene | 218-01-9 | mg/kg | 68:69 | 3.10E-02 | 8.14E-01 | 8.02E-01 | 2.40E+00 | 95% KM (Chebyshev) UCL | 1.00E+00 |
| Di-n-octylphthalate | 117-84-0 | mg/kg | 7:34 | 4.20E-02 | 2.20E-01 | 7.15E-02 | 4.00E-01 | 95% KM (t) UCL | 1.07E-01 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 65:69 | 2.40E-02 | 1.40E-01 | 1.34E-01 | 4.70E-01 | 95% KM (Chebyshev) UCL | 1.74E-01 |
| Fluoranthene | 206-44-0 | mg/kg | 68:69 | 3.70E-02 | 1.30E+00 | 1.27E+00 | 6.00E+00 | 95% KM (Chebyshev) UCL | 1.72E+00 |
| Fluorene | 86-73-7 | mg/kg | 58:69 | 1.20E-02 | 6.30E-02 | 6.04E-02 | 4.10E-01 | KM H-UCL | 6.94E-02 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 68:69 | 2.20E-02 | 5.20E-01 | 5.09E-01 | 1.40E+00 | 95% KM (Chebyshev) UCL | 6.56E-01 |
| Naphthalene | 91-20-3 | mg/kg | 37:69 | 4.90E-03 | 3.70E-02 | 2.93E-02 | 1.30E-01 | KM H-UCL | 3.88E-02 |
| Phenanthrene | 85-01-8 | mg/kg | 67:69 | 9.20E-02 | 5.58E-01 | 5.42E-01 | 4.40E+00 | 95% KM (Chebyshev) UCL | 8.47E-01 |
| Pyrene | 129-00-0 | mg/kg | 68:69 | 3.60E-02 | 9.98E-01 | 9.84E-01 | 4.00E+00 | 95% KM (Chebyshev) UCL | 1.28E+00 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 68:69 | 2.50E-01 | 6.77E+00 | 6.67E+00 | 2.40E+01 | 95% KM (Chebyshev) UCL | 8.57E+00 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 67:69 | 1.50E-01 | 8.62E-01 | 8.37E-01 | 6.30E+00 | KM H-UCL | 1.27E+00 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 68:69 | 2.50E-01 | 7.60E+00 | 7.49E+00 | 3.00E+01 | 95% KM (Chebyshev) UCL | 9.74E+00 |
| **SVOCs (method ID0016)** | | | | | | | | | |
| 1-Methylnaphthalene | 90-12-0 | mg/kg | 34:39 | 1.50E-02 | 5.82E-02 | 5.33E-02 | 2.39E-01 | KM H-UCL | 6.71E-02 |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | mg/kg | 22:22 | 8.90E-03 | 6.41E-02 | -- | 3.90E-01 | 95% Adjusted Gamma UCL | 9.76E-02 |
| 2,6-Dimethylnaphthalene | 581-42-0 | mg/kg | 22:22 | 1.60E-02 | 9.30E-02 | -- | 3.00E-01 | 95% Adjusted Gamma UCL | 1.32E-01 |
| 2-Methylnaphthalene | 91-57-6 | mg/kg | 26:39 | 2.90E-02 | 1.12E-01 | 8.77E-02 | 4.00E-01 | 95% KM Adjusted Gamma UCL | 1.17E-01 |
| Acenaphthene | 83-32-9 | mg/kg | 39:39 | 1.67E-02 | 4.36E-02 | -- | 1.22E-01 | 95% Adjusted Gamma UCL | 5.02E-02 |
| Acenaphthylene | 208-96-8 | mg/kg | 39:39 | 1.10E-02 | 2.72E-02 | -- | 1.30E-01 | 95% Modified-t UCL | 3.25E-02 |
| Anthracene | 120-12-7 | mg/kg | 39:39 | 6.40E-02 | 1.18E-01 | -- | 3.30E-01 | 95% Student's-t UCL | 1.33E-01 |
| Benzo(a)anthracene | 56-55-3 | mg/kg | 39:39 | 2.10E-01 | 7.58E-01 | -- | 1.60E+00 | 95% Student's-t UCL | 8.40E-01 |
| Benzo(a)pyrene | 50-32-8 | mg/kg | 39:39 | 2.50E-01 | 9.47E-01 | -- | 2.20E+00 | 95% Adjusted Gamma UCL | 1.07E+00 |
| Benzo(e)pyrene | 192-97-2 | mg/kg | 39:39 | 2.70E-01 | 8.57E-01 | -- | 1.90E+00 | 95% Student's-t UCL | 9.46E-01 |
| Benzo(g,h,i)perylene | 191-24-2 | mg/kg | 39:39 | 2.50E-01 | 8.63E-01 | -- | 1.70E+00 | 95% Student's-t UCL | 9.49E-01 |
| Benzo(k)fluoranthene | 207-08-9 | mg/kg | 39:39 | 2.10E-01 | 6.85E-01 | -- | 1.50E+00 | 95% Student's-t UCL | 7.64E-01 |
| Chrysene | 218-01-9 | mg/kg | 39:39 | 5.10E-01 | 1.38E+00 | -- | 2.80E+00 | 95% Student's-t UCL | 1.52E+00 |
| Dibenzo(a,h)anthracene | 53-70-3 | mg/kg | 39:39 | 5.10E-02 | 1.39E-01 | -- | 2.30E-01 | 95% Student's-t UCL | 1.51E-01 |
| Fluoranthene | 206-44-0 | mg/kg | 39:39 | 4.40E-01 | 1.67E+00 | -- | 3.70E+00 | 95% Student's-t UCL | 1.86E+00 |
| Fluorene | 86-73-7 | mg/kg | 39:39 | 3.40E-02 | 7.10E-02 | -- | 1.80E-01 | 95% Adjusted Gamma UCL | 8.05E-02 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | mg/kg | 39:39 | 1.90E-01 | 6.93E-01 | -- | 1.50E+00 | 95% Student's-t UCL | 7.65E-01 |
| Naphthalene | 91-20-3 | mg/kg | 18:39 | 4.00E-02 | 9.50E-02 | 8.00E-02 | 2.04E-01 | 95% KM Adjusted Gamma UCL | 9.27E-02 |
| Perylene | 198-55-0 | mg/kg | 39:39 | 1.30E-01 | 3.15E-01 | -- | 6.00E-01 | 95% Student's-t UCL | 3.39E-01 |
| Phenanthrene | 85-01-8 | mg/kg | 39:39 | 3.10E-01 | 7.24E-01 | -- | 1.87E+00 | 95% Student's-t UCL | 8.06E-01 |
| Pyrene | 129-00-0 | mg/kg | 39:39 | 5.40E-01 | 1.51E+00 | -- | 3.20E+00 | 95% Adjusted Gamma UCL | 1.70E+00 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | mg/kg | 39:39 | 3.10E+00 | 1.01E+01 | -- | 2.20E+01 | 95% Student's-t UCL | 1.12E+01 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | mg/kg | 39:39 | 5.54E-01 | 1.02E+00 | -- | 2.74E+00 | 95% Adjusted Gamma UCL | 1.14E+00 |
| Total PAHs (sum 16) | TOT-PAH | mg/kg | 39:39 | 3.90E+00 | 1.12E+01 | -- | 2.30E+01 | 95% Student's-t UCL | 1.23E+01 |

**Attachment B Table 1**
**Selection of Exposure Point Concentrations - Sediment**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | CAS | Units | FOD (a) | Minimum (b, e) | Mean (c, e) | Kaplan-Meier Mean (f) | Maximum (d, e) | UCL Selected (e, g) | EPC (e, g, h) |
|---|---|---|---|---|---|---|---|---|---|
| **VOLATILE ORGANIC COMPOUNDS (VOCs)** | | | | | | | | | |
| Acetone | 67-64-1 | mg/kg | 2:14 | 2.00E-02 | 3.80E-02 | -- | 5.50E-02 | Maximum Detected Value | 5.50E-02 |
| **DIOXIN/FURANS** | | | | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | mg/kg | 34:41 | 5.93E-08 | 3.20E-06 | 2.66E-06 | 3.82E-05 | KM H-UCL | 1.07E-05 |
| 1,2,3,7,8-PeCDD | 40321-76-4 | mg/kg | 39:41 | 4.26E-08 | 1.67E-05 | 1.60E-05 | 2.77E-04 | 95% KM (Chebyshev) UCL | 4.85E-05 |
| 1,2,3,6,7,8-HxCDD | 57653-85-7 | mg/kg | 41:41 | 2.65E-07 | 3.32E-05 | -- | 5.48E-04 | 95% Chebyshev (Mean, Sd) UCL | 9.93E-05 |
| 1,2,3,4,7,8-HxCDD | 39227-28-6 | mg/kg | 39:41 | 1.58E-07 | 1.84E-05 | 1.76E-05 | 2.89E-04 | 95% KM (Chebyshev) UCL | 5.26E-05 |
| 1,2,3,7,8,9-HxCDD | 19408-74-3 | mg/kg | 40:41 | 2.09E-07 | 4.31E-05 | 4.21E-05 | 7.05E-04 | 95% KM (Chebyshev) UCL | 1.29E-04 |
| 1,2,3,4,6,7,8-HpCDD | 35822-46-9 | mg/kg | 41:41 | 8.42E-06 | 3.04E-04 | -- | 4.10E-03 | 95% Chebyshev(Mean, Sd) UCL (j) | 7.87E-04 |
| OCDD | 3268-87-9 | mg/kg | 41:41 | 3.38E-04 | 3.58E-03 | -- | 1.47E-02 | 95% Adjusted Gamma UCL | 4.56E-03 |
| 2,3,7,8-TCDF | 51207-31-9 | mg/kg | 40:41 | 1.27E-07 | 5.39E-06 | 5.26E-06 | 5.67E-05 | KM H-UCL | 1.12E-05 |
| 1,2,3,7,8-PeCDF | 57117-41-6 | mg/kg | 38:41 | 1.13E-07 | 8.82E-06 | 8.20E-06 | 1.24E-04 | 95% KM (Chebyshev) UCL | 2.32E-05 |
| 2,3,4,7,8-PeCDF | 57117-31-4 | mg/kg | 38:41 | 3.45E-07 | 1.76E-05 | 1.63E-05 | 2.17E-04 | 95% KM (Chebyshev) UCL | 4.31E-05 |
| 1,2,3,6,7,8-HxCDF | 57117-44-9 | mg/kg | 36:41 | 1.05E-07 | 2.00E-05 | 1.76E-05 | 2.72E-04 | 95% KM (Chebyshev) UCL | 4.99E-05 |
| 1,2,3,7,8,9-HxCDF | 72918-21-9 | mg/kg | 27:41 | 5.83E-08 | 2.21E-06 | 1.47E-06 | 2.43E-05 | 95% KM (Chebyshev) UCL | 4.42E-06 |
| 1,2,3,4,7,8-HxCDF | 70648-26-9 | mg/kg | 39:41 | 9.02E-08 | 3.09E-05 | 2.95E-05 | 4.70E-04 | 95% KM (Chebyshev) UCL | 8.69E-05 |
| 2,3,4,6,7,8-HxCDF | 60851-34-5 | mg/kg | 39:41 | 7.37E-08 | 1.97E-05 | 1.88E-05 | 2.85E-04 | 95% KM (Chebyshev) UCL | 5.30E-05 |
| 1,2,3,4,6,7,8-HpCDF | 67562-39-4 | mg/kg | 41:41 | 2.37E-07 | 7.74E-05 | -- | 1.08E-03 | 95% Chebyshev(Mean, Sd) UCL (j) | 2.05E-04 |
| 1,2,3,4,7,8,9-HpCDF | 55673-89-7 | mg/kg | 37:41 | 8.00E-08 | 1.04E-05 | 9.43E-06 | 1.51E-04 | 95% KM (Chebyshev) UCL | 2.77E-05 |
| OCDF | 39001-02-0 | mg/kg | 39:41 | 5.14E-07 | 8.92E-05 | 8.56E-05 | 1.00E-03 | KM H-UCL | 1.57E-04 |
| TCDD-TEQ (Bird) | DFTEQ-Bird | mg/kg | 41:41 | 1.47E-07 | 5.46E-05 | -- | 8.15E-04 | 95% Chebyshev (Mean, Sd) UCL | 1.53E-04 |
| TCDD-TEQ (Mammal) | DFTEQ-HH | mg/kg | 41:41 | 3.23E-07 | 4.52E-05 | -- | 7.07E-04 | 95% Chebyshev (Mean, Sd) UCL | 1.30E-04 |

Notes:
COPC - Chemical of Potential Concern.
EPC - Exposure Point Concentration.
FOD - Frequency of Detection.
mg/kg - Milligrams per kilogram.
PAH -
PCBs - Polychlorinated Biphenyls.
SVOCs - Semi-volatile Organic Compounds.
UCL - Upper Confidence Level.
VOCs - Volatile Organic Compounds.
(a) Number of samples detected: Total number of samples.
(b) Minimum detected concentration for each constituent.
(c) Mean of detected concentrations for each constituent.
(d) Maximum detected concentration for each constituent.
(e) Calculated after results for duplicate samples have been resolved by using the maximum detected concentration.
(f) Kaplan-Meier method mean only calculated for datasets containing non-detects.
(g) 95% Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used, unless otherwise noted. Where too few samples or detects are available, the 95% UCL is not calculated.
(h) The EPC is equal to the 95% UCL where a sufficient number of samples and/or detects are available. The EPC is equal to the maximum detected concentration where a sufficient number of samples and/or detects are not available to calculate a UCL.
(j) ProUCL computes and outputs the H-statistic based UCLs for historic reasons only as it often results in unstable (both low and high) values (USEPA, 2010). As such, the 95% Chebyshev UCL was used to estimate the 95% UCL for this data set.

**Attachment B Table 2**
**Selection of Exposure Point Concentrations - Pore Water**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | CAS | Units | FOD (a) | Minimum (b, e) | Mean (c, e) | Maximum (d, e) | UCL Selected (e, g) | EPC (e, f, g) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **INORGANICS - DISSOLVED** | | | | | | | | |
| Barium | 7440-39-3 | ug/l | 15 : 15 | 7.40E+01 | 1.10E+02 | 1.80E+02 | 95% Modified-t UCL | 1.22E+02 |
| Iron | 7439-89-6 | ug/l | 15 : 15 | 4.40E+03 | 1.90E+04 | 6.70E+04 | 95% Chebyshev (Mean, Sd) UCL | 4.34E+04 |
| Manganese | 7439-96-5 | ug/l | 15 : 15 | 1.30E+03 | 4.30E+03 | 1.10E+04 | 95% Adjusted Gamma UCL | 6.47E+03 |
| **INORGANICS - TOTAL** | | | | | | | | |
| Aluminum | 7429-90-5 | ug/l | 15 : 15 | 2.80E+01 | 1.00E+02 | 3.60E+02 | 95% Student's-t UCL | 1.40E+02 |
| Barium | 7440-39-3 | ug/l | 15 : 15 | 9.60E+01 | 1.70E+02 | 3.40E+02 | 95% Adjusted Gamma UCL | 2.15E+02 |
| Iron | 7439-89-6 | ug/l | 15 : 15 | 1.30E+04 | 4.40E+04 | 1.10E+05 | 95% Chebyshev(Mean, Sd) UCL (h) | 8.22E+04 |
| Manganese | 7439-96-5 | ug/l | 15 : 15 | 1.30E+03 | 4.60E+03 | 1.30E+04 | 95% Adjusted Gamma UCL | 7.04E+03 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS - DISSOLVED** | | | | | | | | |
| Pyrene | 129-00-0 | ug/l | 15 : 15 | 2.00E-02 | 3.10E-02 | 2.50E-02 | 95% Modified-t UCL | 4.38E-02 |

Notes:
COPC - Chemical of Potential Concern.
EPC - Exposure Point Concentraion.
FOD - Frequency of Detection.
ug/L - micrograms per liter.
SVOCs - Semi-volatile Organic Compounds.
UCL - Upper Confidence Level.
(a) Number of samples detected: Total number of samples.
(b) Minimum detected concentration for each constituent.
(c) Mean of detected concentrations for each constituent.
(d) Maximum detected concentration for each constituent.
(e) Calculated after results for duplicate samples have been resolved by using the maximum detected concentration.
(f) 95% Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used, unless otherwise noted. Where too few samples or detects are available, the 95% UCL is not calculated.
(g) The EPC is equal to the 95% UCL where a sufficient number of samples and/or detects are available. The EPC is equal to the maximum detected concentration where a sufficient number of samples and/or detects are not available to calculate a UCL.
(h) ProUCL computes and outputs the H-statistic based UCLs for historic reasons only as it often results in unstable (both low and high) values (USEPA, 2010). As such, the 95% Chebyshev UCL was used to estimate the 95% UCL for this data set.

**Attachment B Table 3**
**Selection of Exposure Point Concentrations - Fish Tissue**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | CAS | Units | FOD (a) | Minimum (b, e) | Mean (c, e) | Maximum (d, e) | UCL Selected (e, f) | EPC (e, f, g) |
|---|---|---|---|---|---|---|---|---|
| **INORGANICS** | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 16:28 | 2.90E-02 | 1.48E-01 | 3.80E-01 | 95% KM (t) UCL | 1.38E-01 |
| Cadmium | 7440-43-9 | mg/kg | 10:28 | 7.40E-03 | 1.68E-02 | 2.70E-02 | 95% KM (t) UCL | 1.24E-02 |
| Chromium | 7440-47-3 | mg/kg | 28:28 | 2.90E-01 | 1.14E+00 | 2.10E+00 | 95% Student's-t UCL | 1.30E+00 |
| Copper | 7440-50-8 | mg/kg | 28:28 | 4.90E-01 | 9.49E-01 | 2.00E+00 | 95% Modified-t UCL | 1.09E+00 |
| Lead | 7439-92-1 | mg/kg | 27:28 | 5.90E-02 | 5.23E-01 | 1.50E+00 | 95% GROS Adjusted Gamma UCL | 6.97E-01 |
| Mercury | 7439-97-6 | mg/kg | 9:29 | 1.90E-02 | 5.29E-02 | 8.60E-02 | 95% KM (t) UCL | 3.73E-02 |
| Nickel | 7440-02-0 | mg/kg | 28:28 | 1.20E-01 | 5.01E-01 | 1.20E+00 | 95% Adjusted Gamma UCL | 6.26E-01 |
| Selenium | 7782-49-2 | mg/kg | 21:28 | 2.90E-01 | 3.61E-01 | 4.40E-01 | 95% KM (t) UCL | 3.54E-01 |
| Silver | 7440-22-4 | mg/kg | 4:28 | 5.00E-03 | 6.05E-03 | 8.10E-03 | 95% KM (t) UCL | 4.49E-03 |
| Zinc | 7440-66-6 | mg/kg | 28:28 | 1.70E+01 | 3.18E+01 | 4.40E+01 | 95% Student's-t UCL | 3.38E+01 |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | | | |
| PCB, Total Aroclors | RA_TOT_AROCLOR | ug/kg | 29:29 | 3.10E+01 | 2.11E+02 | 4.40E+02 | 95% Adjusted Gamma UCL | 2.57E+02 |
| PCB, Total Congeners | RA_TOT_PCB_CONG | ug/kg | 28:28 | 1.99E+02 | 3.31E+02 | 4.87E+02 | 95% Student's-t UCL | 3.52E+02 |
| **PESTICIDES** | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 29:29 | 2.00E+00 | 6.22E+00 | 1.10E+01 | 95% Student's-t UCL | 7.05E+00 |
| 4,4'-DDE | 72-55-9 | ug/kg | 29:29 | 7.30E+00 | 1.60E+01 | 2.40E+01 | 95% Student's-t UCL | 1.74E+01 |
| 4,4'-DDT | 50-29-3 | ug/kg | 29:29 | 8.20E-01 | 2.57E+00 | 1.20E+01 | 95% Chebyshev (Mean, Sd) UCL | 4.75E+00 |
| Aldrin | 309-00-2 | ug/kg | 29:29 | 4.00E-01 | 1.21E+00 | 2.40E+00 | 95% Student's-t UCL | 1.36E+00 |
| alpha-BHC | 319-84-6 | ug/kg | 27:29 | 1.80E-01 | 7.24E-01 | 1.90E+00 | 95% KM (t) UCL | 8.11E-01 |
| beta-BHC | 319-85-7 | ug/kg | 16:29 | 1.10E-01 | 8.89E-01 | 2.20E+00 | 95% KM (t) UCL | 7.83E-01 |
| Chlordane | CHLORDANE_ALL | ug/kg | 29:29 | 3.90E+01 | 1.16E+02 | 2.20E+02 | 95% Student's-t UCL | 1.33E+02 |
| delta-BHC | 319-86-8 | ug/kg | 24:29 | 1.60E-01 | 1.38E+00 | 3.20E+00 | 95% KM (t) UCL | 1.41E+00 |
| Dieldrin | 60-57-1 | ug/kg | 28:29 | 1.60E+00 | 5.84E+00 | 1.30E+01 | 95% KM (t) UCL | 6.64E+00 |
| Endrin | 72-20-8 | ug/kg | 29:29 | 1.60E+00 | 4.43E+00 | 1.00E+01 | 95% Student's-t UCL | 4.92E+00 |
| Endosulfan II | 33213-65-9 | ug/kg | 24:29 | 1.90E-01 | 1.27E+00 | 4.40E+00 | 95% GROS Adjusted Gamma UCL | 1.71E+00 |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 29:29 | 7.90E-01 | 1.80E+00 | 4.20E+00 | or 95% Modified-t UCL | 2.08E+00 |
| Heptachlor | 76-44-8 | ug/kg | 11:29 | 3.70E-01 | 1.28E+00 | 2.70E+00 | 95% KM (t) UCL | 7.63E-01 |
| Heptachlor Epoxide | 1024-57-3 | ug/kg | 29:29 | 1.00E+00 | 3.42E+00 | 7.60E+00 | 95% Student's-t UCL | 3.99E+00 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | |
| Total High-molecular-weight PAHs | RA_TOT_PAH_HMW | ug/kg | 1:27 | 1.20E+02 | 1.20E+02 | 1.20E+02 | Maximum Detected Value | 1.20E+02 |
| Total Low-molecular-weight PAHs | RA_TOT_PAH_LMW | ug/kg | 11:27 | 8.60E+00 | 2.18E+01 | 4.10E+01 | 95% KM (t) UCL | 1.73E+01 |
| **DIOXIN/FURANS** | | | | | | | | |
| TCDD-TEQ(Bird) | RA_TCDD-TEQ_BIR | ug/kg | 28:28 | 2.00E-04 | 1.16E-03 | 5.84E-03 | 95% Adjusted Gamma UCL | 1.53E-03 |
| TCDD-TEQ (Mammal) | DFTEQ-HH | ug/kg | 28:28 | 1.50E-04 | 7.27E-04 | 3.34E-03 | 95% Adjusted Gamma UCL | 9.50E-04 |

Notes:
COPC - Chemical of Potential Concern.
EPC - Exposure Point Concentraion.
FOD - Frequency of Detection.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
NV - No Value. Data was not available.
PCBs - Polychlorinated Biphenyls.
SVOCs - Semi-volatile Organic Compounds.
UCL - Upper Confidence Level.
(a) Number of samples detected: Total number of samples.
(b) Minimum detected concentration for each constituent.
(c) Mean of detected concentrations for each constituent.
(d) Maximum detected concentration for each constituent.
(e) Calculated after results for duplicate samples have been resolved by using the maximum detected concentration.
(f) 95% Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used, unless otherwise noted. Where too few samples or detects are available, the 95% UCL is not calculated.
(g) The EPC is equal to the 95% UCL where a sufficient number of samples and/or detects are available. The EPC is equal to the maximum detected concentration where a sufficient number of samples and/or detects are not available to calculate a UCL.

## Attachment B Table 4
## Selection of Exposure Point Concentrations - Benthic Invertebrate Tissue
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| COPC | CAS | Units | FOD (a) | Minimum (b, e) | Mean (c, e) | Maximum (d, e) | UCL Selected (e, f) | EPC (e, f, g) |
|---|---|---|---|---|---|---|---|---|
| **INORGANICS** | | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 13:13 | 3.20E-01 | 7.29E-01 | 1.10E+00 | 95% Student's-t UCL | 8.26E-01 |
| Cadmium | 7440-43-9 | mg/kg | 13:13 | 1.70E-02 | 7.53E-02 | 1.30E-01 | 95% Student's-t UCL | 9.38E-02 |
| Chromium | 7440-47-3 | mg/kg | 13:13 | 3.40E-01 | 2.12E+00 | 5.10E+00 | 95% Student's-t UCL | 2.92E+00 |
| Copper | 7440-50-8 | mg/kg | 13:13 | 9.20E+00 | 4.58E+01 | 1.10E+02 | 95% Student's-t UCL | 6.28E+01 |
| Lead | 7439-92-1 | mg/kg | 13:13 | 2.60E-01 | 1.67E+00 | 4.80E+00 | 95% Adjusted Gamma UCL | 3.09E+00 |
| Mercury | 7439-97-6 | mg/kg | 10:13 | 4.10E-02 | 5.30E-02 | 7.20E-02 | 95% KM (t) UCL | 4.68E-02 |
| Nickel | 7440-02-0 | mg/kg | 13:13 | 5.10E-01 | 1.40E+00 | 3.30E+00 | 95% Student's-t UCL | 1.83E+00 |
| Selenium | 7782-49-2 | mg/kg | 12:13 | 1.40E-01 | 4.27E-01 | 6.90E-01 | 95% KM (t) UCL | 5.05E-01 |
| Silver | 7440-22-4 | mg/kg | 13:13 | 3.60E-02 | 2.93E-01 | 1.00E+00 | 95% Adjusted Gamma UCL | 5.66E-01 |
| Zinc | 7440-66-6 | mg/kg | 13:13 | 1.70E+01 | 4.54E+01 | 8.90E+01 | 95% Chebyshev(Mean, Sd) UCL (h) | 7.60E+01 |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | | | |
| Total PCBs | RA_TOT_AROCLOR | ug/kg | 13:13 | 8.90E+00 | 6.12E+01 | 2.26E+02 | 95% Student's-t UCL | 9.04E+01 |
| **PESTICIDES** | | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 12:12 | 3.80E-01 | 1.66E+00 | 3.70E+00 | 95% KM (t) UCL | 2.00E+00 |
| 4,4'-DDE | 72-55-9 | ug/kg | 12:12 | 8.70E-01 | 3.32E+00 | 9.40E+00 | 95% Student's-t UCL | 4.56E+00 |
| 4,4'-DDT | 50-29-3 | ug/kg | 8:12 | 1.20E-01 | 1.06E+00 | 4.00E+00 | 95% KM Bootstrap t UCL | 3.27E+00 |
| Aldrin | 309-00-2 | ug/kg | 1:12 | 1.40E-01 | 1.40E-01 | 1.40E-01 | Maximum Detected Value | 1.40E-01 |
| alpha-BHC | 319-84-6 | ug/kg | 0:12 | 6.60E-02 (i) | ND | 1.30E-01 (i) | Maximum Reporting Limit | 1.30E-01 |
| beta-BHC | 319-85-7 | ug/kg | 2:12 | 1.70E-01 | 2.90E-01 | 4.10E-01 | Maximum Detected Value | 4.10E-01 |
| Chlordane | CHLORDANE_ALL | ug/kg | 8:10 | 6.70E+00 | 2.76E+01 | 8.40E+01 | 95% KM (t) UCL | 3.17E+01 |
| delta-BHC | 319-86-8 | ug/kg | 1:12 | 7.40E-01 | 7.40E-01 | 7.40E-01 | Maximum Detected Value | 7.40E-01 |
| Dieldrin | 60-57-1 | ug/kg | 12:12 | 3.20E-01 | 1.13E+00 | 2.60E+00 | 95% Student's-t UCL | 1.51E+00 |
| Endrin | 72-20-8 | ug/kg | 9:12 | 2.30E-01 | 1.04E+00 | 2.40E+00 | 95% KM (t) UCL | 1.24E+00 |
| Endosulfan II | 33213-65-9 | ug/kg | 3:12 | 4.60E-01 | 5.63E-01 | 6.20E-01 | Maximum Detected Value | 6.20E-01 |
| gamma-BHC (Lindane) | 58-89-9 | ug/kg | 3:12 | 2.10E-01 | 5.83E-01 | 9.00E-01 | Maximum Detected Value | 9.00E-01 |
| Heptachlor | 76-44-8 | ug/kg | 0:12 | 3.50E-02 (i) | ND | 1.70E-01 (i) | Maximum Reporting Limit | 1.70E-01 |
| Heptachlor Epoxide | 1024-57-3 | ug/kg | 12:12 | 1.40E-01 | 1.22E+00 | 4.80E+00 | 95% Adjusted Gamma UCL | 2.26E+00 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | |
| Total PAHs (sum 16) | RA_TOT_PAH | ug/kg | 4:10 | 4.63E+01 | 1.31E+02 | 2.93E+02 | Maximum Detected Value | 2.93E+02 |

Notes:
COPC - Chemical of Potential Concern.
EPC - Exposure Point Concentration.
FOD - Frequency of Detection.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
ND - Not Detected.
ng/kg - Nanogram per kilogram.
PCBs - Polychlorinated Biphenyls.
SVOCs - Semi-volatile Organic Compounds.
UCL - Upper Confidence Level.
(a) Number of samples detected: Total number of samples.
(b) Minimum detected concentration for each constituent.
(c) Mean of detected concentrations for each constituent.
(d) Maximum detected concentration for each constituent.
(e) Calculated after results for duplicate samples have been resolved by using the maximum detected concentration.
(f) 95% Upper Confidence Limit (UCL) on the arithmetic mean concentration calculated using USEPA ProUCL Version 5.1. The UCL suggested by ProUCL is used, unless otherwise noted. In cases where more than one UCL is suggested, the higher UCL is used, unless otherwise noted. Where too few samples or detects are available, the 95% UCL is not calculated.
(g) The EPC is equal to the 95% UCL where a sufficient number of samples and/or detects are available. The EPC is equal to the maximum detected concentration where a sufficient number o samples and/or detects are not available to calculate a UCL. If a chemical was not detected, the maximum reporting limit is used.
(h) ProUCL computes and outputs the H-statistic based UCLs for historic reasons only as it often results in unstable (both low and high) values (USEPA, 2010). As such, the 95% Chebyshev UCL was used to estimate the 95% UCL for this data set.
(i) Analyte was not detected. The maximum and minimum reporting limits are presented.

**Attachment B Table 5**
**Selection of Exposure Point Concentrations - Critical Body Residue**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | CAS | Units | FOD (a) | Minimum (b, e) | Mean (c, e) | Kaplan-Meier Mean (f) | Maximum (d, e) |
|---|---|---|---|---|---|---|---|
| **INORGANICS** | | | | | | | |
| Arsenic | 7440-38-2 | mg/kg | 24:41 | 2.30E-02 | 1.40E-01 | 1.03E-01 | 3.80E-01 |
| Cadmium | 7440-43-9 | mg/kg | 13:41 | 7.10E-03 | 2.00E-02 | 1.08E-02 | 5.90E-02 |
| Copper | 7440-50-8 | mg/kg | 41:41 | 3.10E-01 | 8.09E-01 | 8.09E-01 | 2.00E+00 |
| Lead | 7439-92-1 | mg/kg | 36:41 | 3.40E-02 | 4.10E-01 | 3.68E-01 | 1.50E+00 |
| Mercury | 7439-97-6 | mg/kg | 14:40 | 1.90E-02 | 1.20E-01 | 5.41E-02 | 6.70E-01 |
| Nickel | 7440-02-0 | mg/kg | 36:41 | 1.20E-01 | 4.80E-01 | 4.25E-01 | 1.20E+00 |
| Selenium | 7782-49-2 | mg/kg | 32:41 | 2.70E-01 | 3.49E-01 | 3.26E-01 | 4.40E-01 |
| Silver | 7440-22-4 | mg/kg | 4:41 | 5.00E-03 | 6.10E-03 | 4.03E-03 | 8.10E-03 |
| Zinc | 7440-66-6 | mg/kg | 41:41 | 1.60E+01 | 2.70E+01 | -- | 4.40E+01 |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | | |
| Total PCBs | RA_TOT_PCB_CONG | ug/kg | 39:39 | 1.99E+02 | 4.20E+02 | -- | 1.74E+03 |
| **PESTICIDES** | | | | | | | |
| 4,4'-DDD | 72-54-8 | ug/kg | 42:42 | 1.90E+00 | 7.00E+00 | -- | 3.70E+01 |
| 4,4'-DDE | 72-55-9 | ug/kg | 42:42 | 7.20E+00 | 2.14E+01 | -- | 1.30E+02 |
| 4,4'-DDT | 50-29-3 | ug/kg | 42:42 | 8.20E-01 | 4.40E+00 | -- | 2.10E+01 |
| Aldrin | 309-00-2 | ug/kg | 42:42 | 4.00E-01 | 1.42E+00 | -- | 8.00E+00 |
| Chlordane | CHLORDANE_ALL | ug/kg | 42:42 | 3.90E+01 | 1.30E+02 | -- | 5.70E+02 |
| Dieldrin | 60-57-1 | ug/kg | 41:42 | 1.60E+00 | 6.10E+00 | 5.91E+00 | 2.10E+01 |
| Endrin | 72-20-8 | ug/kg | 42:42 | 1.60E+00 | 5.30E+00 | -- | 1.80E+01 |
| Heptachlor Epoxide | 1024-57-3 | ug/kg | 42:42 | 1.00E+00 | 3.80E+00 | -- | 1.30E+01 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | |
| Total PAHs (sum 16) | RA_TOT_PAH | ug/kg | 13:36 | 6.60E+00 | 3.70E+01 | 1.92E+01 | 1.60E+02 |

Notes:
COPC - Chemical of Potential Concern.
EPC - Exposure Point Concentraion.
FOD - Frequency of Detection.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
PCBs - Polychlorinated Biphenyls.
SVOCs - Semi-volatile Organic Compounds.
UCL - Upper Confidence Level.
(a) Number of samples detected: Total number of samples.
(b) Minimum detected concentration for each constituent.
(c) Mean of detected concentrations for each constituent.
(d) Maximum detected concentration for each constituent.
(e) Calculated after results for duplicate samples have been resolved by using the maximum detected concentration.
(f) Kaplan-Meier method mean only calculated for datasets containing non-detects.

## UCL Statistics for Data Sets with Non-Detects

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.17/31/2018 11:39:37 AM |
| From File | ERA_Sed_COPCs.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### RA18_SE_DioxinFurans|TCDD TEQ Bird

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 40 |
| | | Number of Missing Observations | 44 |
| Minimum | 1.4700E-7 | Mean | 5.4586E-5 |
| Maximum | 8.1500E-4 | Median | 1.2000E-5 |
| SD | 1.4403E-4 | Std. Error of Mean | 2.2494E-5 |
| Coefficient of Variation | N/A | Skewness | 4.399 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.399 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.353 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 9.2463E-5 | 95% Adjusted-CLT UCL (Chen-1995) | 1.0810E-4 |
| | | 95% Modified-t UCL (Johnson-1978) | 9.5038E-5 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 2.821 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.826 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.224 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.147 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.445 | k star (bias corrected MLE) | 0.428 |
| Theta hat (MLE) | 1.2278E-4 | Theta star (bias corrected MLE) | 1.2745E-4 |
| nu hat (MLE) | 36.46 | nu star (bias corrected) | 35.12 |
| MLE Mean (bias corrected) | 5.4586E-5 | MLE Sd (bias corrected) | 8.3407E-5 |
| | | Approximate Chi Square Value (0.05) | 22.56 |
| Adjusted Level of Significance | 0.0441 | Adjusted Chi Square Value | 22.19 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 8.4970E-5 | 95% Adjusted Gamma UCL (use when n<50) | 8.6380E-5 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.978 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.112 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -15.73 | Mean of logged Data | -11.27 |
| Maximum of Logged Data | -7.112 | SD of logged Data | 1.649 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.1275E-4 | 90% Chebyshev (MVUE) UCL | 9.3932E-5 |
| 95% Chebyshev (MVUE) UCL | 1.1559E-4 | 97.5% Chebyshev (MVUE) UCL | 1.4564E-4 |
| 99% Chebyshev (MVUE) UCL | 2.0468E-4 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 9.1585E-5 | 95% Jackknife UCL | 9.2463E-5 |
| 95% Standard Bootstrap UCL | 9.1902E-5 | 95% Bootstrap-t UCL | 1.8807E-4 |
| 95% Hall's Bootstrap UCL | 2.0755E-4 | 95% Percentile Bootstrap UCL | 9.5483E-5 |
| 95% BCA Bootstrap UCL | 1.1190E-4 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.2207E-4 | 95% Chebyshev(Mean, Sd) UCL | 1.5264E-4 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.9506E-4 | 99% Chebyshev(Mean, Sd) UCL | 2.7840E-4 |

**Suggested UCL to Use**

95% Chebyshev (Mean, Sd) UCL 1.53E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Arsenic

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 84 | Number of Distinct Observations | 49 |
| | | Number of Missing Observations | 1 |
| Minimum | 0.79 | Mean | 4.522 |
| Maximum | 17 | Median | 3.95 |
| SD | 2.969 | Std. Error of Mean | 0.324 |
| Coefficient of Variation | 0.657 | Skewness | 2.388 |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.774 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk P Value | 0 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.168 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level | |
| Data Not Normal at 5% Significance Level | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 5.061 | 95% Adjusted-CLT UCL (Chen-1995) | 5.145 |
| | | 95% Modified-t UCL (Johnson-1978) | 5.075 |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 1.091 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.758 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.0928 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.0982 | Detected data appear Gamma Distributed at 5% Significance Level | |
| Detected data follow Appr. Gamma Distribution at 5% Significance Level | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 3.248 | k star (bias corrected MLE) | 3.14 |
| Theta hat (MLE) | 1.392 | Theta star (bias corrected MLE) | 1.44 |
| nu hat (MLE) | 545.7 | nu star (bias corrected) | 527.6 |
| MLE Mean (bias corrected) | 4.522 | MLE Sd (bias corrected) | 2.552 |
| | | Approximate Chi Square Value (0.05) | 475.3 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 474.5 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 5.019 | 95% Adjusted Gamma UCL (use when n<50) | 5.028 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.978 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk P Value | 0.466 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.0615 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level | |
| Data appear Lognormal at 5% Significance Level | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | -0.236 | Mean of logged Data | 1.347 |
| Maximum of Logged Data | 2.833 | SD of logged Data | 0.563 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 5.065 | 90% Chebyshev (MVUE) UCL | 5.385 |
| 95% Chebyshev (MVUE) UCL | 5.786 | 97.5% Chebyshev (MVUE) UCL | 6.343 |
| 99% Chebyshev (MVUE) UCL | 7.438 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| Data appear to follow a Discernible Distribution at 5% Significance Level | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 5.055 | 95% Jackknife UCL | 5.061 |
| 95% Standard Bootstrap UCL | 5.049 | 95% Bootstrap-t UCL | 5.153 |
| 95% Hall's Bootstrap UCL | 5.199 | 95% Percentile Bootstrap UCL | 5.095 |
| 95% BCA Bootstrap UCL | 5.117 | | |
| 90% Chebyshev(Mean, Sd) UCL | 5.494 | 95% Chebyshev(Mean, Sd) UCL | 5.934 |
| 97.5% Chebyshev(Mean, Sd) UCL | 6.545 | 99% Chebyshev(Mean, Sd) UCL | 7.745 |

Suggested UCL to Use

95% Approximate Gamma UCL 5.019

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Cadmium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 59 |
| | | Number of Missing Observations | 1 |
| Minimum | 0.24 | Mean | 1.197 |
| Maximum | 5.2 | Median | 0.865 |
| SD | 1.026 | Std. Error of Mean | 0.112 |
| Coefficient of Variation | 0.857 | Skewness | 2.153 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.726 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.243 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.384 | 95% Adjusted-CLT UCL (Chen-1995) | 1.41 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.388 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 3.009 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.763 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.175 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0987 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.13 | k star (bias corrected MLE) | 2.062 |
| Theta hat (MLE) | 0.562 | Theta star (bias corrected MLE) | 0.581 |
| nu hat (MLE) | 357.9 | nu star (bias corrected) | 346.5 |
| MLE Mean (bias corrected) | 1.197 | MLE Sd (bias corrected) | 0.834 |
| | | Approximate Chi Square Value (0.05) | 304.3 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 303.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.363 | 95% Adjusted Gamma UCL (use when n<50) | 1.366 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.00413 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.124 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.427 | Mean of logged Data | -0.0725 |
| Maximum of Logged Data | 1.649 | SD of logged Data | 0.673 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.35 | 90% Chebyshev (MVUE) UCL | 1.443 |
| 95% Chebyshev (MVUE) UCL | 1.571 | 97.5% Chebyshev (MVUE) UCL | 1.747 |
| 99% Chebyshev (MVUE) UCL | 2.094 | | |

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution (0.05)

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.382 | 95% Jackknife UCL | 1.384 |
| 95% Standard Bootstrap UCL | 1.379 | 95% Bootstrap-t UCL | 1.424 |
| 95% Hall's Bootstrap UCL | 1.428 | 95% Percentile Bootstrap UCL | 1.388 |
| 95% BCA Bootstrap UCL | 1.411 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.533 | 95% Chebyshev(Mean, Sd) UCL | 1.685 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.896 | 99% Chebyshev(Mean, Sd) UCL | 2.311 |

**Suggested UCL to Use**

95% Chebyshev (Mean, Sd) UCL 1.685

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Copper

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 50 |
| | | Number of Missing Observations | 1 |
| Minimum | 9.6 | Mean | 56.67 |
| Maximum | 240 | Median | 50 |
| SD | 37.48 | Std. Error of Mean | 4.089 |
| Coefficient of Variation | 0.661 | Skewness | 2.504 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.772 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.215 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 63.47 | 95% Adjusted-CLT UCL (Chen-1995) | 64.59 |
| | | 95% Modified-t UCL (Johnson-1978) | 63.66 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.56 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.758 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.14 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0982 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.183 | k star (bias corrected MLE) | 3.077 |
| Theta hat (MLE) | 17.81 | Theta star (bias corrected MLE) | 18.42 |
| nu hat (MLE) | 534.7 | nu star (bias corrected) | 517 |
| MLE Mean (bias corrected) | 56.67 | MLE Sd (bias corrected) | 32.31 |
| | | Approximate Chi Square Value (0.05) | 465.2 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 464.4 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 62.97 | 95% Adjusted Gamma UCL (use when n<50) | 63.09 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.963 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.0714 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.12 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.262 | Mean of logged Data | 3.872 |
| Maximum of Logged Data | 5.481 | SD of logged Data | 0.576 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 63.93 | 90% Chebyshev (MVUE) UCL | 68.03 |
| 95% Chebyshev (MVUE) UCL | 73.21 | 97.5% Chebyshev (MVUE) UCL | 80.4 |
| 99% Chebyshev (MVUE) UCL | 94.52 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 63.4 | 95% Jackknife UCL | 63.47 |
| 95% Standard Bootstrap UCL | 63.49 | 95% Bootstrap-t UCL | 64.87 |
| 95% Hall's Bootstrap UCL | 65.58 | 95% Percentile Bootstrap UCL | 63.62 |
| 95% BCA Bootstrap UCL | 64.8 | | |
| 90% Chebyshev(Mean, Sd) UCL | 68.94 | 95% Chebyshev(Mean, Sd) UCL | 74.49 |
| 97.5% Chebyshev(Mean, Sd) UCL | 82.21 | 99% Chebyshev(Mean, Sd) UCL | 97.36 |

Suggested UCL to Use

| | |
|---|---|
| 95% H-UCL | 63.93 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_Other|Cyanide

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 20 | Number of Distinct Observations | 18 |
| | | Number of Missing Observations | 200 |
| Number of Detects | 15 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 15 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 150 | Minimum Non-Detect | 140 |
| Maximum Detect | 4900 | Maximum Non-Detect | 170 |
| Variance Detects | 1430803 | Percent Non-Detects | 25% |
| Mean Detects | 832.7 | SD Detects | 1196 |
| Median Detects | 480 | CV Detects | 1.437 |
| Skewness Detects | 3.217 | Kurtosis Detects | 11.01 |
| Mean of Logged Detects | 6.241 | SD of Logged Detects | 0.894 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.543 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.881 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.346 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.22 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 659.8 | KM Standard Error of Mean | 241.8 |
| KM SD | 1045 | 95% KM (BCA) UCL | 1153 |
| 95% KM (t) UCL | 1078 | 95% KM (Percentile Bootstrap) UCL | 1108 |
| 95% KM (z) UCL | 1057 | 95% KM Bootstrap t UCL | 2157 |
| 90% KM Chebyshev UCL | 1385 | 95% KM Chebyshev UCL | 1714 |
| 97.5% KM Chebyshev UCL | 2170 | 99% KM Chebyshev UCL | 3065 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 1.059 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.76 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.228 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.227 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.172 | k star (bias corrected MLE) | 0.982 |
| Theta hat (MLE) | 710.6 | Theta star (bias corrected MLE) | 848 |
| nu hat (MLE) | 35.16 | nu star (bias corrected) | 29.46 |
| Mean (detects) | 832.7 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 624.5 |
| Maximum | 4900 | Median | 337.5 |
| SD | 1091 | CV | 1.748 |
| k hat (MLE) | 0.245 | k star (bias corrected MLE) | 0.242 |
| Theta hat (MLE) | 2548 | Theta star (bias corrected MLE) | 2584 |
| nu hat (MLE) | 9.803 | nu star (bias corrected) | 9.666 |
| Adjusted Level of Significance (β) | 0.038 | | |
| Approximate Chi Square Value (9.67, α) | 3.734 | Adjusted Chi Square Value (9.67, β) | 3.447 |
| 95% Gamma Approximate UCL (use when n>=50) | 1617 | 95% Gamma Adjusted UCL (use when n<50) | 1751 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 659.8 | SD (KM) | 1045 |
| Variance (KM) | 1091265 | SE of Mean (KM) | 241.8 |
| k hat (KM) | 0.399 | k star (KM) | 0.372 |
| nu hat (KM) | 15.95 | nu star (KM) | 14.89 |
| theta hat (KM) | 1654 | theta star (KM) | 1772 |
| 80% gamma percentile (KM) | 1055 | 90% gamma percentile (KM) | 1886 |
| 95% gamma percentile (KM) | 2809 | 99% gamma percentile (KM) | 5148 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (14.89, α) | 7.188 | Adjusted Chi Square Value (14.89, β) | 6.768 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1367 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1452 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.926 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.15 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 641.8 | Mean in Log Scale | 5.735 |
| SD in Original Scale | 1081 | SD in Log Scale | 1.187 |
| 95% t UCL (assumes normality of ROS data) | 1060 | 95% Percentile Bootstrap UCL | 1093 |
| 95% BCA Bootstrap UCL | 1347 | 95% Bootstrap t UCL | 2058 |
| 95% H-UCL (Log ROS) | 1384 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | 5.918 | KM Geo Mean | 371.5 |
| KM SD (logged) | 0.934 | 95% Critical H Value (KM-Log) | 2.54 |
| KM Standard Error of Mean (logged) | 0.216 | 95% H-UCL (KM -Log) | 990.6 |
| KM SD (logged) | 0.934 | 95% Critical H Value (KM-Log) | 2.54 |
| KM Standard Error of Mean (logged) | 0.216 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 643.5 | Mean in Log Scale | 5.763 |
| SD in Original Scale | 1080 | SD in Log Scale | 1.146 |
| 95% t UCL (Assumes normality) | 1061 | 95% H-Stat UCL | 1298 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

KM H-UCL 990.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_Metals|Lead

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 52 |
| | | Number of Missing Observations | 1 |
| Minimum | 11 | Mean | 76.04 |
| Maximum | 320 | Median | 61.5 |
| SD | 48.44 | Std. Error of Mean | 5.286 |
| Coefficient of Variation | 0.637 | Skewness | 2.199 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.825 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 3.275E-14 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.172 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 84.83 | 95% Adjusted-CLT UCL (Chen-1995) | 86.08 |
| | | 95% Modified-t UCL (Johnson-1978) | 85.04 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.225 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.758 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.114 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0982 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.209 | k star (bias corrected MLE) | 3.103 |
| Theta hat (MLE) | 23.69 | Theta star (bias corrected MLE) | 24.51 |
| nu hat (MLE) | 539.2 | nu star (bias corrected) | 521.2 |
| MLE Mean (bias corrected) | 76.04 | MLE Sd (bias corrected) | 43.17 |
| | | Approximate Chi Square Value (0.05) | 469.3 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 468.4 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 84.45 | 95% Adjusted Gamma UCL (use when n<50) | 84.61 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.98 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.561 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0969 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

**Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.398 | Mean of logged Data | 4.167 |
| Maximum of Logged Data | 5.768 | SD of logged Data | 0.576 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 85.87 | 90% Chebyshev (MVUE) UCL | 91.37 |
| 95% Chebyshev (MVUE) UCL | 98.33 | 97.5% Chebyshev (MVUE) UCL | 108 |
| 99% Chebyshev (MVUE) UCL | 126.9 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 84.73 | 95% Jackknife UCL | 84.83 |
| 95% Standard Bootstrap UCL | 85.01 | 95% Bootstrap-t UCL | 86.96 |
| 95% Hall's Bootstrap UCL | 86.77 | 95% Percentile Bootstrap UCL | 84.74 |
| 95% BCA Bootstrap UCL | 85.71 | | |
| 90% Chebyshev(Mean, Sd) UCL | 91.89 | 95% Chebyshev(Mean, Sd) UCL | 99.07 |
| 97.5% Chebyshev(Mean, Sd) UCL | 109 | 99% Chebyshev(Mean, Sd) UCL | 128.6 |

Suggested UCL to Use

| | |
|---|---|
| 95% H-UCL | 85.87 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_Metals|Mercury

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 43 |
| | | Number of Missing Observations | 1 |
| Minimum | 0.033 | Mean | 0.197 |
| Maximum | 0.69 | Median | 0.18 |
| SD | 0.111 | Std. Error of Mean | 0.0121 |
| Coefficient of Variation | 0.566 | Skewness | 1.472 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.909 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 2.0238E-6 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0979 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.217 | 95% Adjusted-CLT UCL (Chen-1995) | 0.219 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.217 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.255 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.758 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0522 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0981 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.333 | k star (bias corrected MLE) | 3.222 |
| Theta hat (MLE) | 0.059 | Theta star (bias corrected MLE) | 0.061 |
| nu hat (MLE) | 560 | nu star (bias corrected) | 541.3 |
| MLE Mean (bias corrected) | 0.197 | MLE Sd (bias corrected) | 0.109 |
| | | Approximate Chi Square Value (0.05) | 488.4 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 487.5 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.218 | 95% Adjusted Gamma UCL (use when n<50) | 0.218 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.973 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.284 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0828 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.411 | Mean of logged Data | -1.785 |
| Maximum of Logged Data | -0.371 | SD of logged Data | 0.589 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.226 | 90% Chebyshev (MVUE) UCL | 0.24 |
| 95% Chebyshev (MVUE) UCL | 0.259 | 97.5% Chebyshev (MVUE) UCL | 0.285 |
| 99% Chebyshev (MVUE) UCL | 0.336 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.216 | 95% Jackknife UCL | 0.217 |
| 95% Standard Bootstrap UCL | 0.216 | 95% Bootstrap-t UCL | 0.219 |
| 95% Hall's Bootstrap UCL | 0.22 | 95% Percentile Bootstrap UCL | 0.217 |
| 95% BCA Bootstrap UCL | 0.217 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.233 | 95% Chebyshev(Mean, Sd) UCL | 0.249 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.272 | 99% Chebyshev(Mean, Sd) UCL | 0.317 |

**Suggested UCL to Use**

95% Approximate Gamma UCL 0.218

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Nickel

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 47 |
| | | Number of Missing Observations | 1 |
| Minimum | 7.7 | Mean | 38.84 |
| Maximum | 160 | Median | 32 |
| SD | 27.71 | Std. Error of Mean | 3.024 |
| Coefficient of Variation | 0.714 | Skewness | 2.501 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.734 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.228 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 43.87 | 95% Adjusted-CLT UCL (Chen-1995) | 44.69 |
| | | 95% Modified-t UCL (Johnson-1978) | 44 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 2.209 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.759 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.145 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0982 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.031 | k star (bias corrected MLE) | 2.93 |
| Theta hat (MLE) | 12.81 | Theta star (bias corrected MLE) | 13.25 |
| nu hat (MLE) | 509.1 | nu star (bias corrected) | 492.3 |
| MLE Mean (bias corrected) | 38.84 | MLE Sd (bias corrected) | 22.69 |
| | | Approximate Chi Square Value (0.05) | 441.8 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 441 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 43.27 | 95% Adjusted Gamma UCL (use when n<50) | 43.35 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.964 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.0742 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.102 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.041 | Mean of logged Data | 3.485 |
| Maximum of Logged Data | 5.075 | SD of logged Data | 0.566 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 43.08 | 90% Chebyshev (MVUE) UCL | 45.81 |
| 95% Chebyshev (MVUE) UCL | 49.24 | 97.5% Chebyshev (MVUE) UCL | 54 |
| 99% Chebyshev (MVUE) UCL | 63.36 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 43.81 | 95% Jackknife UCL | 43.87 |
| 95% Standard Bootstrap UCL | 43.8 | 95% Bootstrap-t UCL | 44.92 |
| 95% Hall's Bootstrap UCL | 44.83 | 95% Percentile Bootstrap UCL | 43.93 |
| 95% BCA Bootstrap UCL | 44.23 | | |
| 90% Chebyshev(Mean, Sd) UCL | 47.91 | 95% Chebyshev(Mean, Sd) UCL | 52.02 |
| 97.5% Chebyshev(Mean, Sd) UCL | 57.72 | 99% Chebyshev(Mean, Sd) UCL | 68.92 |

Suggested UCL to Use

| | |
|---|---|
| 95% H-UCL | 43.08 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_Metals|Selenium

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 50 |
| | | Number of Missing Observations | 1 |
| Minimum | 0.034 | Mean | 0.93 |
| Maximum | 2.75 | Median | 0.905 |
| SD | 0.526 | Std. Error of Mean | 0.0574 |
| Coefficient of Variation | 0.565 | Skewness | 1.003 |

| Normal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.929 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk P Value | 1.1937E-4 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.102 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

| Assuming Normal Distribution | | | |
|---|---|---|---|
| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 95% Student's-t UCL | 1.026 | 95% Adjusted-CLT UCL (Chen-1995) | 1.031 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.027 |

| Gamma GOF Test | | |
|---|---|---|
| A-D Test Statistic | 0.899 | Anderson-Darling Gamma GOF Test |
| 5% A-D Critical Value | 0.76 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0953 | Kolmogorov-Smirnov Gamma GOF Test |
| 5% K-S Critical Value | 0.0984 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 2.724 | k star (bias corrected MLE) | 2.635 |
| Theta hat (MLE) | 0.341 | Theta star (bias corrected MLE) | 0.353 |
| nu hat (MLE) | 457.6 | nu star (bias corrected) | 442.6 |
| MLE Mean (bias corrected) | 0.93 | MLE Sd (bias corrected) | 0.573 |
| | | Approximate Chi Square Value (0.05) | 394.8 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 394 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 1.043 | 95% Adjusted Gamma UCL (use when n<50) | 1.045 |

| Lognormal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.915 | Shapiro Wilk Lognormal GOF Test |
| 5% Shapiro Wilk P Value | 6.9620E-6 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.12 | Lilliefors Lognormal GOF Test |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.381 | Mean of logged Data | -0.267 |
| Maximum of Logged Data | 1.012 | SD of logged Data | 0.711 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 1.153 | 90% Chebyshev (MVUE) UCL | 1.235 |
| 95% Chebyshev (MVUE) UCL | 1.349 | 97.5% Chebyshev (MVUE) UCL | 1.508 |
| 99% Chebyshev (MVUE) UCL | 1.82 | | |

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 1.025 | 95% Jackknife UCL | 1.026 |
| 95% Standard Bootstrap UCL | 1.022 | 95% Bootstrap-t UCL | 1.035 |
| 95% Hall's Bootstrap UCL | 1.037 | 95% Percentile Bootstrap UCL | 1.026 |
| 95% BCA Bootstrap UCL | 1.041 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.102 | 95% Chebyshev(Mean, Sd) UCL | 1.18 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.288 | 99% Chebyshev(Mean, Sd) UCL | 1.501 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Approximate Gamma UCL | 1.043 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Silver

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 61 |
| | | Number of Missing Observations | 1 |
| Minimum | 0.044 | Mean | 0.519 |
| Maximum | 3.5 | Median | 0.335 |
| SD | 0.576 | Std. Error of Mean | 0.0628 |
| Coefficient of Variation | 1.108 | Skewness | 3.309 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.661 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.214 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.624 | 95% Adjusted-CLT UCL (Chen-1995) | 0.647 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.628 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.314 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.772 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.103 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0995 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.433 | k star (bias corrected MLE) | 1.39 |
| Theta hat (MLE) | 0.362 | Theta star (bias corrected MLE) | 0.374 |
| nu hat (MLE) | 240.8 | nu star (bias corrected) | 233.6 |
| MLE Mean (bias corrected) | 0.519 | MLE Sd (bias corrected) | 0.44 |
| | | Approximate Chi Square Value (0.05) | 199.2 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 198.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.609 | 95% Adjusted Gamma UCL (use when n<50) | 0.611 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.987 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.887 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0426 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.124 | Mean of logged Data | -1.043 |
| Maximum of Logged Data | 1.253 | SD of logged Data | 0.865 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.626 | 90% Chebyshev (MVUE) UCL | 0.675 |
| 95% Chebyshev (MVUE) UCL | 0.75 | 97.5% Chebyshev (MVUE) UCL | 0.855 |
| 99% Chebyshev (MVUE) UCL | 1.06 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.623 | 95% Jackknife UCL | 0.624 |
| 95% Standard Bootstrap UCL | 0.621 | 95% Bootstrap-t UCL | 0.664 |
| 95% Hall's Bootstrap UCL | 0.685 | 95% Percentile Bootstrap UCL | 0.629 |
| 95% BCA Bootstrap UCL | 0.645 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.708 | 95% Chebyshev(Mean, Sd) UCL | 0.793 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.912 | 99% Chebyshev(Mean, Sd) UCL | 1.144 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% H-UCL | 0.626 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_Metals|Zinc

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 1 |
| Minimum | 46 | Mean | 223 |
| Maximum | 630 | Median | 200 |
| SD | 113.6 | Std. Error of Mean | 12.4 |
| Coefficient of Variation | 0.51 | Skewness | 1.473 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.885 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 1.1727E-8 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.134 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 243.6 | 95% Adjusted-CLT UCL (Chen-1995) | 245.5 |
| | | 95% Modified-t UCL (Johnson-1978) | 243.9 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.608 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.756 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0784 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0979 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.311 | k star (bias corrected MLE) | 4.165 |
| Theta hat (MLE) | 51.72 | Theta star (bias corrected MLE) | 53.54 |
| nu hat (MLE) | 724.2 | nu star (bias corrected) | 699.7 |
| MLE Mean (bias corrected) | 223 | MLE Sd (bias corrected) | 109.3 |
| | | Approximate Chi Square Value (0.05) | 639.3 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 638.3 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 244 | 95% Adjusted Gamma UCL (use when n<50) | 244.4 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.971 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.213 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0926 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.829 | Mean of logged Data | 5.287 |
| Maximum of Logged Data | 6.446 | SD of logged Data | 0.505 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 248.8 | 90% Chebyshev (MVUE) UCL | 263.3 |
| 95% Chebyshev (MVUE) UCL | 281 | 97.5% Chebyshev (MVUE) UCL | 305.6 |
| 99% Chebyshev (MVUE) UCL | 353.9 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 243.4 | 95% Jackknife UCL | 243.6 |
| 95% Standard Bootstrap UCL | 243 | 95% Bootstrap-t UCL | 246 |
| 95% Hall's Bootstrap UCL | 247 | 95% Percentile Bootstrap UCL | 243.2 |
| 95% BCA Bootstrap UCL | 243.4 | | |
| 90% Chebyshev(Mean, Sd) UCL | 260.2 | 95% Chebyshev(Mean, Sd) UCL | 277 |
| 97.5% Chebyshev(Mean, Sd) UCL | 300.4 | 99% Chebyshev(Mean, Sd) UCL | 346.3 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Approximate Gamma UCL | 244 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|4,4'-DDD

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 38 |
| | | Number of Missing Observations | 36 |
| Minimum | 7.6000E-4 | Mean | 0.00589 |
| Maximum | 0.068 | Median | 0.0039 |
| SD | 0.0094 | Std. Error of Mean | 0.00134 |
| Coefficient of Variation | 1.596 | Skewness | 6.251 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.355 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.298 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.126 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.00814 | 95% Adjusted-CLT UCL (Chen-1995) | 0.00938 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.00834 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 2.877 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.766 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.168 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.129 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.648 | k star (bias corrected MLE) | 1.56 |
| Theta hat (MLE) | 0.00358 | Theta star (bias corrected MLE) | 0.00378 |
| nu hat (MLE) | 161.5 | nu star (bias corrected) | 152.9 |
| MLE Mean (bias corrected) | 0.00589 | MLE Sd (bias corrected) | 0.00472 |
| | | Approximate Chi Square Value (0.05) | 125.3 |
| Adjusted Level of Significance | 0.0451 | Adjusted Chi Square Value | 124.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.00719 | 95% Adjusted Gamma UCL (use when n<50) | 0.00723 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.931 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0847 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.126 | Data appear Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -7.182 | Mean of logged Data | -5.467 |
| Maximum of Logged Data | -2.688 | SD of logged Data | 0.681 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.00649 | 90% Chebyshev (MVUE) UCL | 0.00697 |
| 95% Chebyshev (MVUE) UCL | 0.00773 | 97.5% Chebyshev (MVUE) UCL | 0.00879 |
| 99% Chebyshev (MVUE) UCL | 0.0109 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.0081 | 95% Jackknife UCL | 0.00814 |
| 95% Standard Bootstrap UCL | 0.00807 | 95% Bootstrap-t UCL | 0.0129 |
| 95% Hall's Bootstrap UCL | 0.0165 | 95% Percentile Bootstrap UCL | 0.00838 |
| 95% BCA Bootstrap UCL | 0.01 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.00992 | 95% Chebyshev(Mean, Sd) UCL | 0.0117 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.0143 | 99% Chebyshev(Mean, Sd) UCL | 0.0193 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% H-UCL | 0.00649 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Surface Sediment

RA18_SE_PestPCBs|4,4'-DDE

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 48 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 38 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.0014 | Minimum Non-Detect | 0.0013 |
| Maximum Detect | 0.056 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 1.0373E-4 | Percent Non-Detects | 2.041% |
| Mean Detects | 0.00961 | SD Detects | 0.0102 |
| Median Detects | 0.0061 | CV Detects | 1.06 |
| Skewness Detects | 2.928 | Kurtosis Detects | 9.796 |
| Mean of Logged Detects | -4.968 | SD of Logged Detects | 0.747 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.648 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.28 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.127 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.00944 | KM Standard Error of Mean | 0.00145 |
| KM SD | 0.01 | 95% KM (BCA) UCL | 0.012 |
| 95% KM (t) UCL | 0.0119 | 95% KM (Percentile Bootstrap) UCL | 0.012 |
| 95% KM (z) UCL | 0.0118 | 95% KM Bootstrap t UCL | 0.0134 |
| 90% KM Chebyshev UCL | 0.0138 | 95% KM Chebyshev UCL | 0.0158 |
| 97.5% KM Chebyshev UCL | 0.0185 | 99% KM Chebyshev UCL | 0.0239 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 2.269 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.765 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.199 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.13 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.697 | k star (bias corrected MLE) | 1.604 |
| Theta hat (MLE) | 0.00566 | Theta star (bias corrected MLE) | 0.00599 |
| nu hat (MLE) | 162.9 | nu star (bias corrected) | 154 |
| Mean (detects) | 0.00961 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0014 | Mean | 0.00962 |
| Maximum | 0.056 | Median | 0.0061 |
| SD | 0.0101 | CV | 1.048 |
| k hat (MLE) | 1.729 | k star (bias corrected MLE) | 1.637 |
| Theta hat (MLE) | 0.00556 | Theta star (bias corrected MLE) | 0.00588 |
| nu hat (MLE) | 169.5 | nu star (bias corrected) | 160.4 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (160.41, α) | 132.1 | Adjusted Chi Square Value (160.41, β) | 131.4 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0117 | 95% Gamma Adjusted UCL (use when n<50) | 0.0117 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00944 | SD (KM) | 0.01 |
| Variance (KM) | 1.0088E-4 | SE of Mean (KM) | 0.00145 |
| k hat (KM) | 0.883 | k star (KM) | 0.843 |
| nu hat (KM) | 86.57 | nu star (KM) | 82.6 |
| theta hat (KM) | 0.0107 | theta star (KM) | 0.0112 |
| 80% gamma percentile (KM) | 0.0154 | 90% gamma percentile (KM) | 0.0227 |
| 95% gamma percentile (KM) | 0.0301 | 99% gamma percentile (KM) | 0.0474 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (82.60, α) | 62.65 | Adjusted Chi Square Value (82.60, β) | 62.13 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0124 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0126 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.952 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.136 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.127 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data appear Approximate Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00943 | Mean in Log Scale | -5.007 |
| SD in Original Scale | 0.0102 | SD in Log Scale | 0.787 |
| 95% t UCL (assumes normality of ROS data) | 0.0119 | 95% Percentile Bootstrap UCL | 0.0119 |
| 95% BCA Bootstrap UCL | 0.0125 | 95% Bootstrap t UCL | 0.0133 |
| 95% H-UCL (Log ROS) | 0.0116 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -5.002 | KM Geo Mean | 0.00672 |
| KM SD (logged) | 0.769 | 95% Critical H Value (KM-Log) | 2.102 |
| KM Standard Error of Mean (logged) | 0.111 | 95% H-UCL (KM -Log) | 0.0114 |
| KM SD (logged) | 0.769 | 95% Critical H Value (KM-Log) | 2.102 |
| KM Standard Error of Mean (logged) | 0.111 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.00943 | Mean in Log Scale | -5.016 |
| SD in Original Scale | 0.0102 | SD in Log Scale | 0.813 |
| 95% t UCL (Assumes normality) | 0.0119 | 95% H-Stat UCL | 0.0119 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

KM H-UCL 0.0114

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|4,4'-DDT

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 34 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 33 | Number of Non-Detects | 16 |
| Number of Distinct Detects | 26 | Number of Distinct Non-Detects | 11 |
| Minimum Detect | 3.7000E-4 | Minimum Non-Detect | 4.4000E-5 |
| Maximum Detect | 1.5 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 0.0678 | Percent Non-Detects | 32.65% |
| Mean Detects | 0.0512 | SD Detects | 0.26 |
| Median Detects | 0.0025 | CV Detects | 5.085 |
| Skewness Detects | 5.722 | Kurtosis Detects | 32.81 |
| Mean of Logged Detects | -5.78 | SD of Logged Detects | 1.532 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.2 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.931 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.47 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.152 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0346 | KM Standard Error of Mean | 0.0307 |
| KM SD | 0.212 | 95% KM (BCA) UCL | 0.0957 |
| 95% KM (t) UCL | 0.0862 | 95% KM (Percentile Bootstrap) UCL | 0.0953 |
| 95% KM (z) UCL | 0.0852 | 95% KM Bootstrap t UCL | 1.29 |
| 90% KM Chebyshev UCL | 0.127 | 95% KM Chebyshev UCL | 0.169 |
| 97.5% KM Chebyshev UCL | 0.227 | 99% KM Chebyshev UCL | 0.34 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 7.666 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.879 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.407 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.168 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.253 | k star (bias corrected MLE) | 0.25 |
| Theta hat (MLE) | 0.203 | Theta star (bias corrected MLE) | 0.205 |
| nu hat (MLE) | 16.67 | nu star (bias corrected) | 16.48 |
| Mean (detects) | 0.0512 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 3.7000E-4 | Mean | 0.0378 |
| Maximum | 1.5 | Median | 0.0048 |
| SD | 0.214 | CV | 5.656 |
| k hat (MLE) | 0.322 | k star (bias corrected MLE) | 0.316 |
| Theta hat (MLE) | 0.117 | Theta star (bias corrected MLE) | 0.12 |
| nu hat (MLE) | 31.52 | nu star (bias corrected) | 30.92 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (30.92, α) | 19.22 | Adjusted Chi Square Value (30.92, β) | 18.94 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0607 | 95% Gamma Adjusted UCL (use when n<50) | 0.0616 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0346 | SD (KM) | 0.212 |
| Variance (KM) | 0.0449 | SE of Mean (KM) | 0.0307 |
| k hat (KM) | 0.0267 | k star (KM) | 0.0387 |
| nu hat (KM) | 2.619 | nu star (KM) | 3.792 |
| theta hat (KM) | 1.296 | theta star (KM) | 0.895 |
| 80% gamma percentile (KM) | 0.00162 | 90% gamma percentile (KM) | 0.0353 |
| 95% gamma percentile (KM) | 0.163 | 99% gamma percentile (KM) | 0.828 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (3.79, α) | 0.641 | Adjusted Chi Square Value (3.79, β) | 0.605 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.205 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.217 |

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

### Lognormal GOF Test on Detected Observations Only

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.78 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.931 | Detected Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.202 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.152 | Detected Data Not Lognormal at 5% Significance Level | |

Detected Data Not Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0346 | Mean in Log Scale | -6.684 |
| SD in Original Scale | 0.214 | SD in Log Scale | 1.845 |
| 95% t UCL (assumes normality of ROS data) | 0.0858 | 95% Percentile Bootstrap UCL | 0.0952 |
| 95% BCA Bootstrap UCL | 0.156 | 95% Bootstrap t UCL | 2.397 |
| 95% H-UCL (Log ROS) | 0.0169 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -6.681 | KM Geo Mean | 0.00125 |
| KM SD (logged) | 1.955 | 95% Critical H Value (KM-Log) | 3.549 |
| KM Standard Error of Mean (logged) | 0.336 | 95% H-UCL (KM -Log) | 0.0231 |
| KM SD (logged) | 1.955 | 95% Critical H Value (KM-Log) | 3.549 |
| KM Standard Error of Mean (logged) | 0.336 | | |

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.0346 | Mean in Log Scale | -6.488 |
| SD in Original Scale | 0.214 | SD in Log Scale | 1.721 |
| 95% t UCL (Assumes normality) | 0.0859 | 95% H-Stat UCL | 0.0149 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

### Suggested UCL to Use

95% KM (Chebyshev) UCL 0.169

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Aldrin

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 40 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 30 | Number of Non-Detects | 19 |
| Number of Distinct Detects | 28 | Number of Distinct Non-Detects | 13 |
| Minimum Detect | 7.4000E-5 | Minimum Non-Detect | 4.1000E-5 |
| Maximum Detect | 0.003 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 2.9979E-7 | Percent Non-Detects | 38.78% |
| Mean Detects | 5.9663E-4 | SD Detects | 5.4753E-4 |
| Median Detects | 4.9500E-4 | CV Detects | 0.918 |
| Skewness Detects | 3.325 | Kurtosis Detects | 13.23 |
| Mean of Logged Detects | -7.677 | SD of Logged Detects | 0.706 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.642 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.283 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 4.84E-04 | KM Standard Error of Mean | 7.2051E-5 |
| KM SD | 4.7227E-4 | 95% KM (BCA) UCL | 6.1314E-4 |
| 95% KM (t) UCL | 6.0450E-4 | 95% KM (Percentile Bootstrap) UCL | 6.0339E-4 |
| 95% KM (z) UCL | 6.0217E-4 | 95% KM Bootstrap t UCL | 6.5205E-4 |
| 90% KM Chebyshev UCL | 6.9981E-4 | 95% KM Chebyshev UCL | 7.9772E-4 |
| 97.5% KM Chebyshev UCL | 9.3361E-4 | 99% KM Chebyshev UCL | 0.0012 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.874 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.758 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.176 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.162 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.128 | k star (bias corrected MLE) | 1.937 |
| Theta hat (MLE) | 2.8036E-4 | Theta star (bias corrected MLE) | 3.0794E-4 |
| nu hat (MLE) | 127.7 | nu star (bias corrected) | 116.2 |
| Mean (detects) | 5.9663E-4 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 7.4000E-5 | Mean | 0.00424 |
| Maximum | 0.01 | Median | 7.3000E-4 |
| SD | 0.00465 | CV | 1.096 |
| k hat (MLE) | 0.603 | k star (bias corrected MLE) | 0.58 |
| Theta hat (MLE) | 0.00703 | Theta star (bias corrected MLE) | 0.00732 |
| nu hat (MLE) | 59.12 | nu star (bias corrected) | 56.83 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (56.83, α) | 40.5 | Adjusted Chi Square Value (56.83, β) | 40.08 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00595 | 95% Gamma Adjusted UCL (use when n<50) | 0.00602 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 4.8366E-4 | SD (KM) | 4.7227E-4 |
| Variance (KM) | 2.2303E-7 | SE of Mean (KM) | 7.2051E-5 |
| k hat (KM) | 1.049 | k star (KM) | 0.998 |
| nu hat (KM) | 102.8 | nu star (KM) | 97.83 |
| theta hat (KM) | 4.6114E-4 | theta star (KM) | 4.8452E-4 |
| 80% gamma percentile (KM) | 7.7853E-4 | 90% gamma percentile (KM) | 0.00111 |
| 95% gamma percentile (KM) | 0.00145 | 99% gamma percentile (KM) | 0.00223 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (97.83, α) | 76.01 | Adjusted Chi Square Value (97.83, β) | 75.43 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 6.2247E-4 | 95% Gamma Adjusted KM-UCL (use when n<50) | 6.2728E-4 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.961 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.141 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 4.8005E-4 | Mean in Log Scale | -7.909 |
| SD in Original Scale | 4.6049E-4 | SD in Log Scale | 0.719 |
| 95% t UCL (assumes normality of ROS data) | 5.9038E-4 | 95% Percentile Bootstrap UCL | 5.9553E-4 |
| 95% BCA Bootstrap UCL | 6.3459E-4 | 95% Bootstrap t UCL | 6.8144E-4 |
| 95% H-UCL (Log ROS) | 5.8863E-4 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -8.049 | KM Geo Mean | 3.1937E-4 |
| KM SD (logged) | 1.019 | 95% Critical H Value (KM-Log) | 2.36 |
| KM Standard Error of Mean (logged) | 0.173 | 95% H-UCL (KM -Log) | 7.5986E-4 |
| KM SD (logged) | 1.019 | 95% Critical H Value (KM-Log) | 2.36 |
| KM Standard Error of Mean (logged) | 0.173 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 5.2428E-4 | Mean in Log Scale | -7.902 |
| SD in Original Scale | 4.5877E-4 | SD in Log Scale | 1.001 |
| 95% t UCL (Assumes normality) | 6.3420E-4 | 95% H-Stat UCL | 8.5697E-4 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

KM H-UCL 7.60E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_PestPCBs|gamma-chlordane

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 15 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 2 |
| Number of Detects | 14 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 13 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.022 | Minimum Non-Detect | 1.5000E-4 |
| Maximum Detect | 0.13 | Maximum Non-Detect | 1.5000E-4 |
| Variance Detects | 6.7242E-4 | Percent Non-Detects | 6.667% |
| Mean Detects | 0.0565 | SD Detects | 0.0259 |
| Median Detects | 0.05 | CV Detects | 0.459 |
| Skewness Detects | 1.86 | Kurtosis Detects | 4.695 |
| Mean of Logged Detects | -2.956 | SD of Logged Detects | 0.413 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.832 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.874 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.247 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.226 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0527 | KM Standard Error of Mean | 0.00748 |
| KM SD | 0.0279 | 95% KM (BCA) UCL | 0.0655 |
| 95% KM (t) UCL | 0.0659 | 95% KM (Percentile Bootstrap) UCL | 0.0651 |
| 95% KM (z) UCL | 0.0651 | 95% KM Bootstrap t UCL | 0.0691 |
| 90% KM Chebyshev UCL | 0.0752 | 95% KM Chebyshev UCL | 0.0854 |
| 97.5% KM Chebyshev UCL | 0.0995 | 99% KM Chebyshev UCL | 0.127 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.468 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.737 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.19 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.229 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.257 | k star (bias corrected MLE) | 4.963 |
| Theta hat (MLE) | 0.00903 | Theta star (bias corrected MLE) | 0.0114 |
| nu hat (MLE) | 175.2 | nu star (bias corrected) | 139 |
| Mean (detects) | 0.0565 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.0534 |
| Maximum | 0.13 | Median | 0.049 |
| SD | 0.0277 | CV | 0.519 |
| k hat (MLE) | 3.846 | k star (bias corrected MLE) | 3.122 |
| Theta hat (MLE) | 0.0139 | Theta star (bias corrected MLE) | 0.0171 |
| nu hat (MLE) | 115.4 | nu star (bias corrected) | 93.65 |
| Adjusted Level of Significance (β) | 0.0324 | | |
| Approximate Chi Square Value (93.65, α) | 72.33 | Adjusted Chi Square Value (93.65, β) | 70.03 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0691 | 95% Gamma Adjusted UCL (use when n<50) | 0.0714 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0527 | SD (KM) | 0.0279 |
| Variance (KM) | 7.8034E-4 | SE of Mean (KM) | 0.00748 |
| k hat (KM) | 3.565 | k star (KM) | 2.896 |
| nu hat (KM) | 106.9 | nu star (KM) | 86.89 |
| theta hat (KM) | 0.0148 | theta star (KM) | 0.0182 |
| 80% gamma percentile (KM) | 0.0755 | 90% gamma percentile (KM) | 0.0943 |
| 95% gamma percentile (KM) | 0.112 | 99% gamma percentile (KM) | 0.15 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (86.89, α) | 66.4 | Adjusted Chi Square Value (86.89, β) | 64.2 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.069 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0714 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.955 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.874 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.166 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.226 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.054 | Mean in Log Scale | -3.021 |
| SD in Original Scale | 0.0268 | SD in Log Scale | 0.471 |
| 95% t UCL (assumes normality of ROS data) | 0.0662 | 95% Percentile Bootstrap UCL | 0.066 |
| 95% BCA Bootstrap UCL | 0.0682 | 95% Bootstrap t UCL | 0.0719 |
| 95% H-UCL (Log ROS) | 0.0704 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.346 | KM Geo Mean | 0.0352 |
| KM SD (logged) | 1.509 | 95% Critical H Value (KM-Log) | 3.628 |
| KM Standard Error of Mean (logged) | 0.404 | 95% H-UCL (KM -Log) | 0.475 |
| KM SD (logged) | 1.509 | 95% Critical H Value (KM-Log) | 3.628 |
| KM Standard Error of Mean (logged) | 0.404 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0527 | Mean in Log Scale | -3.392 |
| SD in Original Scale | 0.0289 | SD in Log Scale | 1.735 |
| 95% t UCL (Assumes normality) | 0.0659 | 95% H-Stat UCL | 0.994 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 0.0714 | 95% GROS Adjusted Gamma UCL | 0.0714 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|cis-Chlordane

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 26 |
| | | Number of Missing Observations | 56 |
| Minimum | 0.0014 | Mean | 0.00773 |
| Maximum | 0.018 | Median | 0.0067 |
| SD | 0.00404 | Std. Error of Mean | 7.5075E-4 |
| Coefficient of Variation | 0.523 | Skewness | 0.763 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.149 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.00901 | 95% Adjusted-CLT UCL (Chen-1995) | 0.00908 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.00903 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.516 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.752 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.138 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.164 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.316 | k star (bias corrected MLE) | 2.996 |
| Theta hat (MLE) | 0.00233 | Theta star (bias corrected MLE) | 0.00258 |
| nu hat (MLE) | 192.3 | nu star (bias corrected) | 173.8 |
| MLE Mean (bias corrected) | 0.00773 | MLE Sd (bias corrected) | 0.00447 |
| | | Approximate Chi Square Value (0.05) | 144.3 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 142.7 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.00931 | 95% Adjusted Gamma UCL (use when n<50) | 0.00942 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.913 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.178 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -6.571 | Mean of logged Data | -5.021 |
| Maximum of Logged Data | -4.017 | SD of logged Data | 0.625 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.0102 | 90% Chebyshev (MVUE) UCL | 0.0109 |
| 95% Chebyshev (MVUE) UCL | 0.0123 | 97.5% Chebyshev (MVUE) UCL | 0.0141 |
| 99% Chebyshev (MVUE) UCL | 0.0178 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.00897 | 95% Jackknife UCL | 0.00901 |
| 95% Standard Bootstrap UCL | 0.00895 | 95% Bootstrap-t UCL | 0.00916 |
| 95% Hall's Bootstrap UCL | 0.00923 | 95% Percentile Bootstrap UCL | 0.00904 |
| 95% BCA Bootstrap UCL | 0.00908 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.00998 | 95% Chebyshev(Mean, Sd) UCL | 0.011 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.0124 | 99% Chebyshev(Mean, Sd) UCL | 0.0152 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 0.00901 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Dieldrin

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 34 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 39 | Number of Non-Detects | 10 |
| Number of Distinct Detects | 26 | Number of Distinct Non-Detects | 10 |
| Minimum Detect | 2.6000E-4 | Minimum Non-Detect | 4.0000E-5 |
| Maximum Detect | 0.014 | Maximum Non-Detect | 0.0012 |
| Variance Detects | 5.0787E-6 | Percent Non-Detects | 20.41% |
| Mean Detects | 0.00225 | SD Detects | 0.00225 |
| Median Detects | 0.0015 | CV Detects | 1.001 |
| Skewness Detects | 3.958 | Kurtosis Detects | 19.73 |
| Mean of Logged Detects | -6.374 | SD of Logged Detects | 0.73 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.616 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.235 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.00185 | KM Standard Error of Mean | 3.1071E-4 |
| KM SD | 0.00214 | 95% KM (BCA) UCL | 0.0024 |
| 95% KM (t) UCL | 0.00237 | 95% KM (Percentile Bootstrap) UCL | 0.00239 |
| 95% KM (z) UCL | 0.00236 | 95% KM Bootstrap t UCL | 0.00276 |
| 90% KM Chebyshev UCL | 0.00278 | 95% KM Chebyshev UCL | 0.00321 |
| 97.5% KM Chebyshev UCL | 0.00379 | 99% KM Chebyshev UCL | 0.00494 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.922 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.76 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.137 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.143 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.946 | k star (bias corrected MLE) | 1.814 |
| Theta hat (MLE) | 0.00116 | Theta star (bias corrected MLE) | 0.00124 |
| nu hat (MLE) | 151.8 | nu star (bias corrected) | 141.5 |
| Mean (detects) | 0.00225 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 2.6000E-4 | Mean | 0.00383 |
| Maximum | 0.014 | Median | 0.002 |
| SD | 0.00374 | CV | 0.975 |
| k hat (MLE) | 1.254 | k star (bias corrected MLE) | 1.19 |
| Theta hat (MLE) | 0.00306 | Theta star (bias corrected MLE) | 0.00322 |
| nu hat (MLE) | 122.9 | nu star (bias corrected) | 116.7 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (116.66, α) | 92.72 | Adjusted Chi Square Value (116.66, β) | 92.08 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00482 | 95% Gamma Adjusted UCL (use when n<50) | 0.00486 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00185 | SD (KM) | 0.00214 |
| Variance (KM) | 4.5863E-6 | SE of Mean (KM) | 3.1071E-4 |
| k hat (KM) | 0.747 | k star (KM) | 0.715 |
| nu hat (KM) | 73.23 | nu star (KM) | 70.08 |
| theta hat (KM) | 0.00248 | theta star (KM) | 0.00259 |
| 80% gamma percentile (KM) | 0.00304 | 90% gamma percentile (KM) | 0.00462 |
| 95% gamma percentile (KM) | 0.00625 | 99% gamma percentile (KM) | 0.0101 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (70.08, α) | 51.81 | Adjusted Chi Square Value (70.08, β) | 51.33 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0025 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.00253 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.975 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.124 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00188 | Mean in Log Scale | -6.658 |
| SD in Original Scale | 0.00214 | SD in Log Scale | 0.87 |
| 95% t UCL (assumes normality of ROS data) | 0.00239 | 95% Percentile Bootstrap UCL | 0.00243 |
| 95% BCA Bootstrap UCL | 0.0027 | 95% Bootstrap t UCL | 0.00274 |
| 95% H-UCL (Log ROS) | 0.00247 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -6.902 | KM Geo Mean | 0.00101 |
| KM SD (logged) | 1.364 | 95% Critical H Value (KM-Log) | 2.761 |
| KM Standard Error of Mean (logged) | 0.217 | 95% H-UCL (KM -Log) | 0.00439 |
| KM SD (logged) | 1.364 | 95% Critical H Value (KM-Log) | 2.761 |
| KM Standard Error of Mean (logged) | 0.217 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00186 | Mean in Log Scale | -6.808 |
| SD in Original Scale | 0.00215 | SD in Log Scale | 1.244 |
| 95% t UCL (Assumes normality) | 0.00238 | 95% H-Stat UCL | 0.00383 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 0.00253 | 95% GROS Adjusted Gamma UCL | 0.00486 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Endrin

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 36 | Number of Non-Detects | 13 |
| Number of Distinct Detects | 32 | Number of Distinct Non-Detects | 9 |
| Minimum Detect | 3.1000E-4 | Minimum Non-Detect | 7.3000E-4 |
| Maximum Detect | 0.022 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 2.4227E-5 | Percent Non-Detects | 26.53% |
| Mean Detects | 0.00435 | SD Detects | 0.00492 |
| Median Detects | 0.0028 | CV Detects | 1.131 |
| Skewness Detects | 2.528 | Kurtosis Detects | 6.98 |
| Mean of Logged Detects | -5.923 | SD of Logged Detects | 1.027 |

| Normal GOF Test on Detects Only | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.699 | Shapiro Wilk GOF Test | |
| 5% Shapiro Wilk Critical Value | 0.935 | Detected Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.213 | Lilliefors GOF Test | |
| 5% Lilliefors Critical Value | 0.145 | Detected Data Not Normal at 5% Significance Level | |
| Detected Data Not Normal at 5% Significance Level | | | |

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.00335 | KM Standard Error of Mean | 6.5006E-4 |
| KM SD | 0.00448 | 95% KM (BCA) UCL | 0.0047 |
| 95% KM (t) UCL | 0.00444 | 95% KM (Percentile Bootstrap) UCL | 0.00455 |
| 95% KM (z) UCL | 0.00442 | 95% KM Bootstrap t UCL | 0.00491 |
| 90% KM Chebyshev UCL | 0.0053 | 95% KM Chebyshev UCL | 0.00618 |
| 97.5% KM Chebyshev UCL | 0.00741 | 99% KM Chebyshev UCL | 0.00982 |

| Gamma GOF Tests on Detected Observations Only | | | |
|---|---|---|---|
| A-D Test Statistic | 0.442 | Anderson-Darling GOF Test | |
| 5% A-D Critical Value | 0.773 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.11 | Kolmogorov-Smirnov GOF | |
| 5% K-S Critical Value | 0.151 | Detected data appear Gamma Distributed at 5% Significance Level | |
| Detected data appear Gamma Distributed at 5% Significance Level | | | |

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 1.168 | k star (bias corrected MLE) | 1.089 |
| Theta hat (MLE) | 0.00373 | Theta star (bias corrected MLE) | 0.004 |
| nu hat (MLE) | 84.08 | nu star (bias corrected) | 78.41 |
| Mean (detects) | 0.00435 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 3.1000E-4 | Mean | 0.00585 |
| Maximum | 0.022 | Median | 0.0044 |
| SD | 0.0049 | CV | 0.837 |
| k hat (MLE) | 1.299 | k star (bias corrected MLE) | 1.233 |
| Theta hat (MLE) | 0.0045 | Theta star (bias corrected MLE) | 0.00475 |
| nu hat (MLE) | 127.3 | nu star (bias corrected) | 120.8 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (120.82, α) | 96.44 | Adjusted Chi Square Value (120.82, β) | 95.78 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00733 | 95% Gamma Adjusted UCL (use when n<50) | 0.00738 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.00335 | SD (KM) | 0.00448 |
| Variance (KM) | 2.0100E-5 | SE of Mean (KM) | 6.5006E-4 |
| k hat (KM) | 0.558 | k star (KM) | 0.538 |
| nu hat (KM) | 54.73 | nu star (KM) | 52.71 |
| theta hat (KM) | 0.006 | theta star (KM) | 0.00623 |
| 80% gamma percentile (KM) | 0.00552 | 90% gamma percentile (KM) | 0.00893 |
| 95% gamma percentile (KM) | 0.0125 | 99% gamma percentile (KM) | 0.0214 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (52.71, α) | 37.03 | Adjusted Chi Square Value (52.71, β) | 36.63 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.00477 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.00482 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.981 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.935 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0731 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.145 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00336 | Mean in Log Scale | -6.329 |
| SD in Original Scale | 0.00452 | SD in Log Scale | 1.121 |
| 95% t UCL (assumes normality of ROS data) | 0.00444 | 95% Percentile Bootstrap UCL | 0.00443 |
| 95% BCA Bootstrap UCL | 0.00476 | 95% Bootstrap t UCL | 0.00503 |
| 95% H-UCL (Log ROS) | 0.00499 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -6.351 | KM Geo Mean | 0.00174 |
| KM SD (logged) | 1.142 | 95% Critical H Value (KM-Log) | 2.497 |
| KM Standard Error of Mean (logged) | 0.172 | 95% H-UCL (KM -Log) | 0.00505 |
| KM SD (logged) | 1.142 | 95% Critical H Value (KM-Log) | 2.497 |
| KM Standard Error of Mean (logged) | 0.172 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00333 | Mean in Log Scale | -6.362 |
| SD in Original Scale | 0.00454 | SD in Log Scale | 1.15 |
| 95% t UCL (Assumes normality) | 0.00442 | 95% H-Stat UCL | 0.00507 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Gamma Distributed at 5% Significance Level

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 0.00482 | 95% GROS Adjusted Gamma UCL | 0.00738 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Heptachlor Epoxide

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 46 | Number of Non-Detects | 3 |
| Number of Distinct Detects | 37 | Number of Distinct Non-Detects | 3 |
| Minimum Detect | 1.2000E-4 | Minimum Non-Detect | 4.7000E-5 |
| Maximum Detect | 0.0065 | Maximum Non-Detect | 0.0011 |
| Variance Detects | 2.3252E-6 | Percent Non-Detects | 6.122% |
| Mean Detects | 0.00153 | SD Detects | 0.00152 |
| Median Detects | 8.9000E-4 | CV Detects | 0.998 |
| Skewness Detects | 1.883 | Kurtosis Detects | 3.158 |
| Mean of Logged Detects | -6.875 | SD of Logged Detects | 0.881 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.751 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.945 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.216 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.129 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.00145 | KM Standard Error of Mean | 2.1621E-4 |
| KM SD | 0.0015 | 95% KM (BCA) UCL | 0.00182 |
| 95% KM (t) UCL | 0.00181 | 95% KM (Percentile Bootstrap) UCL | 0.00184 |
| 95% KM (z) UCL | 0.0018 | 95% KM Bootstrap t UCL | 0.00191 |
| 90% KM Chebyshev UCL | 0.0021 | 95% KM Chebyshev UCL | 0.00239 |
| 97.5% KM Chebyshev UCL | 0.0028 | 99% KM Chebyshev UCL | 0.0036 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.331 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.769 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.149 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.133 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.422 | k star (bias corrected MLE) | 1.344 |
| Theta hat (MLE) | 0.00107 | Theta star (bias corrected MLE) | 0.00114 |
| nu hat (MLE) | 130.8 | nu star (bias corrected) | 123.6 |
| Mean (detects) | 0.00153 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.2000E-4 | Mean | 0.00205 |
| Maximum | 0.01 | Median | 9.9000E-4 |
| SD | 0.00253 | CV | 1.235 |
| k hat (MLE) | 1.054 | k star (bias corrected MLE) | 1.003 |
| Theta hat (MLE) | 0.00194 | Theta star (bias corrected MLE) | 0.00204 |
| nu hat (MLE) | 103.3 | nu star (bias corrected) | 98.29 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (98.29, α) | 76.42 | Adjusted Chi Square Value (98.29, β) | 75.84 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00263 | 95% Gamma Adjusted UCL (use when n<50) | 0.00265 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00145 | SD (KM) | 0.0015 |
| Variance (KM) | 2.2396E-6 | SE of Mean (KM) | 2.1621E-4 |
| k hat (KM) | 0.936 | k star (KM) | 0.892 |
| nu hat (KM) | 91.72 | nu star (KM) | 87.44 |
| theta hat (KM) | 0.00155 | theta star (KM) | 0.00162 |
| 80% gamma percentile (KM) | 0.00235 | 90% gamma percentile (KM) | 0.00343 |
| 95% gamma percentile (KM) | 0.00452 | 99% gamma percentile (KM) | 0.00706 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (87.44, α) | 66.88 | Adjusted Chi Square Value (87.44, β) | 66.34 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.00189 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.00191 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.968 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.945 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.118 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.129 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00145 | Mean in Log Scale | -6.974 |
| SD in Original Scale | 0.00151 | SD in Log Scale | 0.954 |
| 95% t UCL (assumes normality of ROS data) | 0.00181 | 95% Percentile Bootstrap UCL | 0.00182 |
| 95% BCA Bootstrap UCL | 0.00188 | 95% Bootstrap t UCL | 0.0019 |
| 95% H-UCL (Log ROS) | 0.00202 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -7.018 | KM Geo Mean | 8.9565E-4 |
| KM SD (logged) | 1.053 | 95% Critical H Value (KM-Log) | 2.397 |
| KM Standard Error of Mean (logged) | 0.153 | 95% H-UCL (KM -Log) | 0.00224 |
| KM SD (logged) | 1.053 | 95% Critical H Value (KM-Log) | 2.397 |
| KM Standard Error of Mean (logged) | 0.153 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00145 | Mean in Log Scale | -7.03 |
| SD in Original Scale | 0.00151 | SD in Log Scale | 1.107 |
| 95% t UCL (Assumes normality) | 0.00181 | 95% H-Stat UCL | 0.00242 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

KM H-UCL 0.00224

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Methoxychlor

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 18 |
| | | Number of Missing Observations | 57 |
| Number of Detects | 14 | Number of Non-Detects | 14 |
| Number of Distinct Detects | 10 | Number of Distinct Non-Detects | 8 |
| Minimum Detect | 0.0017 | Minimum Non-Detect | 7.3000E-4 |
| Maximum Detect | 0.027 | Maximum Non-Detect | 0.0012 |
| Variance Detects | 4.4147E-5 | Percent Non-Detects | 50% |
| Mean Detects | 0.0129 | SD Detects | 0.00664 |
| Median Detects | 0.012 | CV Detects | 0.517 |
| Skewness Detects | 0.635 | Kurtosis Detects | 0.663 |
| Mean of Logged Detects | -4.519 | SD of Logged Detects | 0.678 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.935 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.874 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.217 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.226 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.00679 | KM Standard Error of Mean | 0.00148 |
| KM SD | 0.00756 | 95% KM (BCA) UCL | 0.0095 |
| 95% KM (t) UCL | 0.00932 | 95% KM (Percentile Bootstrap) UCL | 0.00931 |
| 95% KM (z) UCL | 0.00923 | 95% KM Bootstrap t UCL | 0.00979 |
| 90% KM Chebyshev UCL | 0.0112 | 95% KM Chebyshev UCL | 0.0133 |
| 97.5% KM Chebyshev UCL | 0.0161 | 99% KM Chebyshev UCL | 0.0216 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.531 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.742 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.241 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.23 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.193 | k star (bias corrected MLE) | 2.557 |
| Theta hat (MLE) | 0.00402 | Theta star (bias corrected MLE) | 0.00503 |
| nu hat (MLE) | 89.41 | nu star (bias corrected) | 71.59 |
| Mean (detects) | 0.0129 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0017 | Mean | 0.0114 |
| Maximum | 0.027 | Median | 0.01 |
| SD | 0.00483 | CV | 0.423 |
| k hat (MLE) | 5.706 | k star (bias corrected MLE) | 5.119 |
| Theta hat (MLE) | 0.002 | Theta star (bias corrected MLE) | 0.00223 |
| nu hat (MLE) | 319.5 | nu star (bias corrected) | 286.6 |
| Adjusted Level of Significance (β) | 0.0404 | | |
| Approximate Chi Square Value (286.65, α) | 248.4 | Adjusted Chi Square Value (286.65, β) | 246.2 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0132 | 95% Gamma Adjusted UCL (use when n<50) | 0.0133 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00679 | SD (KM) | 0.00756 |
| Variance (KM) | 5.7221E-5 | SE of Mean (KM) | 0.00148 |
| k hat (KM) | 0.806 | k star (KM) | 0.743 |
| nu hat (KM) | 45.12 | nu star (KM) | 41.62 |
| theta hat (KM) | 0.00843 | theta star (KM) | 0.00914 |
| 80% gamma percentile (KM) | 0.0111 | 90% gamma percentile (KM) | 0.0168 |
| 95% gamma percentile (KM) | 0.0226 | 99% gamma percentile (KM) | 0.0364 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (41.62, α) | 27.83 | Adjusted Chi Square Value (41.62, β) | 27.13 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0102 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0104 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.859 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.874 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.271 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.226 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0076 | Mean in Log Scale | -5.309 |
| SD in Original Scale | 0.00708 | SD in Log Scale | 0.957 |
| 95% t UCL (assumes normality of ROS data) | 0.00987 | 95% Percentile Bootstrap UCL | 0.00976 |
| 95% BCA Bootstrap UCL | 0.00986 | 95% Bootstrap t UCL | 0.0103 |
| 95% H-UCL (Log ROS) | 0.0122 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -5.871 | KM Geo Mean | 0.00282 |
| KM SD (logged) | 1.429 | 95% Critical H Value (KM-Log) | 3.027 |
| KM Standard Error of Mean (logged) | 0.28 | 95% H-UCL (KM -Log) | 0.018 |
| KM SD (logged) | 1.429 | 95% Critical H Value (KM-Log) | 3.027 |
| KM Standard Error of Mean (logged) | 0.28 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00668 | Mean in Log Scale | -6.05 |
| SD in Original Scale | 0.00779 | SD in Log Scale | 1.632 |
| 95% t UCL (Assumes normality) | 0.00919 | 95% H-Stat UCL | 0.0253 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.00932

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|PCB, Total Aroclors (AECOM Calc)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 66 |
| | | Number of Missing Observations | 1 |
| Number of Detects | 83 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 65 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.0031 | Minimum Non-Detect | 0.0084 |
| Maximum Detect | 1.9 | Maximum Non-Detect | 0.0084 |
| Variance Detects | 0.137 | Percent Non-Detects | 1.19% |
| Mean Detects | 0.313 | SD Detects | 0.37 |
| Median Detects | 0.17 | CV Detects | 1.18 |
| Skewness Detects | 2.352 | Kurtosis Detects | 6.424 |
| Mean of Logged Detects | -1.733 | SD of Logged Detects | 1.128 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.721 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.232 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0974 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.309 | KM Standard Error of Mean | 0.0403 |
| KM SD | 0.367 | 95% KM (BCA) UCL | 0.377 |
| 95% KM (t) UCL | 0.376 | 95% KM (Percentile Bootstrap) UCL | 0.374 |
| 95% KM (z) UCL | 0.376 | 95% KM Bootstrap t UCL | 0.393 |
| 90% KM Chebyshev UCL | 0.43 | 95% KM Chebyshev UCL | 0.485 |
| 97.5% KM Chebyshev UCL | 0.561 | 99% KM Chebyshev UCL | 0.71 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.427 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.782 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.116 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.101 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.008 | k star (bias corrected MLE) | 0.979 |
| Theta hat (MLE) | 0.311 | Theta star (bias corrected MLE) | 0.32 |
| nu hat (MLE) | 167.3 | nu star (bias corrected) | 162.6 |
| Mean (detects) | 0.313 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0031 | Mean | 0.309 |
| Maximum | 1.9 | Median | 0.165 |
| SD | 0.369 | CV | 1.192 |
| k hat (MLE) | 0.973 | k star (bias corrected MLE) | 0.947 |
| Theta hat (MLE) | 0.318 | Theta star (bias corrected MLE) | 0.327 |
| nu hat (MLE) | 163.5 | nu star (bias corrected) | 159 |
| Adjusted Level of Significance (β) | 0.0471 | | |
| Approximate Chi Square Value (159.04, α) | 130.9 | Adjusted Chi Square Value (159.04, β) | 130.4 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.376 | 95% Gamma Adjusted UCL (use when n<50) | 0.377 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.309 | SD (KM) | 0.367 |
| Variance (KM) | 0.134 | SE of Mean (KM) | 0.0403 |
| k hat (KM) | 0.712 | k star (KM) | 0.694 |
| nu hat (KM) | 119.6 | nu star (KM) | 116.7 |
| theta hat (KM) | 0.435 | theta star (KM) | 0.446 |
| 80% gamma percentile (KM) | 0.509 | 90% gamma percentile (KM) | 0.778 |
| 95% gamma percentile (KM) | 1.056 | 99% gamma percentile (KM) | 1.72 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (116.66, α) | 92.72 | Adjusted Chi Square Value (116.66, β) | 92.35 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.389 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.391 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.979 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.528 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0483 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0974 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.31 | Mean in Log Scale | -1.766 |
| SD in Original Scale | 0.369 | SD in Log Scale | 1.159 |
| 95% t UCL (assumes normality of ROS data) | 0.376 | 95% Percentile Bootstrap UCL | 0.38 |
| 95% BCA Bootstrap UCL | 0.387 | 95% Bootstrap t UCL | 0.391 |
| 95% H-UCL (Log ROS) | 0.454 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -1.782 | KM Geo Mean | 0.168 |
| KM SD (logged) | 1.198 | 95% Critical H Value (KM-Log) | 2.433 |
| KM Standard Error of Mean (logged) | 0.131 | 95% H-UCL (KM -Log) | 0.475 |
| KM SD (logged) | 1.198 | 95% Critical H Value (KM-Log) | 2.433 |
| KM Standard Error of Mean (logged) | 0.131 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.309 | Mean in Log Scale | -1.778 |
| SD in Original Scale | 0.369 | SD in Log Scale | 1.193 |
| 95% t UCL (Assumes normality) | 0.376 | 95% H-Stat UCL | 0.473 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

KM H-UCL 0.475

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|trans-Chlordane

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 24 |
| | | Number of Missing Observations | 56 |
| Number of Detects | 24 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 19 | Number of Distinct Non-Detects | 5 |
| Minimum Detect | 0.0019 | Minimum Non-Detect | 7.3000E-4 |
| Maximum Detect | 0.031 | Maximum Non-Detect | 0.0012 |
| Variance Detects | 3.9210E-5 | Percent Non-Detects | 17.24% |
| Mean Detects | 0.00995 | SD Detects | 0.00626 |
| Median Detects | 0.00935 | CV Detects | 0.629 |
| Skewness Detects | 2.068 | Kurtosis Detects | 5.608 |
| Mean of Logged Detects | -4.78 | SD of Logged Detects | 0.62 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.779 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.916 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.267 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.177 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.00836 | KM Standard Error of Mean | 0.00125 |
| KM SD | 0.00657 | 95% KM (BCA) UCL | 0.0107 |
| 95% KM (t) UCL | 0.0105 | 95% KM (Percentile Bootstrap) UCL | 0.0104 |
| 95% KM (z) UCL | 0.0104 | 95% KM Bootstrap t UCL | 0.0109 |
| 90% KM Chebyshev UCL | 0.0121 | 95% KM Chebyshev UCL | 0.0138 |
| 97.5% KM Chebyshev UCL | 0.0161 | 99% KM Chebyshev UCL | 0.0208 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.989 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.19 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.179 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.104 | k star (bias corrected MLE) | 2.743 |
| Theta hat (MLE) | 0.00321 | Theta star (bias corrected MLE) | 0.00363 |
| nu hat (MLE) | 149 | nu star (bias corrected) | 131.7 |
| Mean (detects) | 0.00995 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0019 | Mean | 0.00996 |
| Maximum | 0.031 | Median | 0.0095 |
| SD | 0.00568 | CV | 0.57 |
| k hat (MLE) | 3.719 | k star (bias corrected MLE) | 3.358 |
| Theta hat (MLE) | 0.00268 | Theta star (bias corrected MLE) | 0.00297 |
| nu hat (MLE) | 215.7 | nu star (bias corrected) | 194.7 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (194.74, α) | 163.5 | Adjusted Chi Square Value (194.74, β) | 161.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0119 | 95% Gamma Adjusted UCL (use when n<50) | 0.012 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00836 | SD (KM) | 0.00657 |
| Variance (KM) | 4.3228E-5 | SE of Mean (KM) | 0.00125 |
| k hat (KM) | 1.617 | k star (KM) | 1.473 |
| nu hat (KM) | 93.78 | nu star (KM) | 85.41 |
| theta hat (KM) | 0.00517 | theta star (KM) | 0.00568 |
| 80% gamma percentile (KM) | 0.013 | 90% gamma percentile (KM) | 0.0175 |
| 95% gamma percentile (KM) | 0.0219 | 99% gamma percentile (KM) | 0.0319 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (85.41, α) | 65.11 | Adjusted Chi Square Value (85.41, β) | 64.05 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.011 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0111 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.901 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.916 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.194 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.177 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00864 | Mean in Log Scale | -5.001 |
| SD in Original Scale | 0.00639 | SD in Log Scale | 0.748 |
| 95% t UCL (assumes normality of ROS data) | 0.0107 | 95% Percentile Bootstrap UCL | 0.0106 |
| 95% BCA Bootstrap UCL | 0.0112 | 95% Bootstrap t UCL | 0.0114 |
| 95% H-UCL (Log ROS) | 0.0121 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -5.201 | KM Geo Mean | 0.00551 |
| KM SD (logged) | 1.075 | 95% Critical H Value (KM-Log) | 2.562 |
| KM Standard Error of Mean (logged) | 0.204 | 95% H-UCL (KM -Log) | 0.0165 |
| KM SD (logged) | 1.075 | 95% Critical H Value (KM-Log) | 2.562 |
| KM Standard Error of Mean (logged) | 0.204 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00832 | Mean in Log Scale | -5.269 |
| SD in Original Scale | 0.00674 | SD in Log Scale | 1.229 |
| 95% t UCL (Assumes normality) | 0.0104 | 95% H-Stat UCL | 0.0208 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 0.0138

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Total High-molecular-weight PAHs

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 51 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 50 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.25 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 24 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 12.65 | Percent Non-Detects | 1.449% |
| Mean Detects | 6.768 | SD Detects | 3.557 |
| Median Detects | 6.05 | CV Detects | 0.526 |
| Skewness Detects | 1.957 | Kurtosis Detects | 7.589 |
| Mean of Logged Detects | 1.766 | SD of Logged Detects | 0.625 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.875 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 1.5575E-7 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.14 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 6.67 | KM Standard Error of Mean | 0.436 |
| KM SD | 3.597 | 95% KM (BCA) UCL | 7.435 |
| 95% KM (t) UCL | 7.398 | 95% KM (Percentile Bootstrap) UCL | 7.382 |
| 95% KM (z) UCL | 7.388 | 95% KM Bootstrap t UCL | 7.565 |
| 90% KM Chebyshev UCL | 7.979 | 95% KM Chebyshev UCL | 8.572 |
| 97.5% KM Chebyshev UCL | 9.395 | 99% KM Chebyshev UCL | 11.01 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.413 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.756 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.15 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.566 | k star (bias corrected MLE) | 3.418 |
| Theta hat (MLE) | 1.898 | Theta star (bias corrected MLE) | 1.98 |
| nu hat (MLE) | 484.9 | nu star (bias corrected) | 464.9 |
| Mean (detects) | 6.768 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.25 | Mean | 6.685 |
| Maximum | 24 | Median | 6 |
| SD | 3.599 | CV | 0.538 |
| k hat (MLE) | 3.282 | k star (bias corrected MLE) | 3.149 |
| Theta hat (MLE) | 2.037 | Theta star (bias corrected MLE) | 2.123 |
| nu hat (MLE) | 452.9 | nu star (bias corrected) | 434.6 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (434.57, α) | 387.2 | Adjusted Chi Square Value (434.57, β) | 386.3 |
| 95% Gamma Approximate UCL (use when n>=50) | 7.502 | 95% Gamma Adjusted UCL (use when n<50) | 7.52 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 6.67 | SD (KM) | 3.597 |
| Variance (KM) | 12.94 | SE of Mean (KM) | 0.436 |
| k hat (KM) | 3.439 | k star (KM) | 3.299 |
| nu hat (KM) | 474.5 | nu star (KM) | 455.2 |
| theta hat (KM) | 1.94 | theta star (KM) | 2.022 |
| 80% gamma percentile (KM) | 9.407 | 90% gamma percentile (KM) | 11.59 |
| 95% gamma percentile (KM) | 13.63 | 99% gamma percentile (KM) | 18.01 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (455.25, α) | 406.8 | Adjusted Chi Square Value (455.25, β) | 405.8 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 7.465 | 95% Gamma Adjusted KM-UCL (use when n<50) | 7.483 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.859 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 1.3841E-8 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.193 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 6.689 | Mean in Log Scale | 1.744 |
| SD in Original Scale | 3.591 | SD in Log Scale | 0.646 |
| 95% t UCL (assumes normality of ROS data) | 7.41 | 95% Percentile Bootstrap UCL | 7.407 |
| 95% BCA Bootstrap UCL | 7.55 | 95% Bootstrap t UCL | 7.532 |
| 95% H-UCL (Log ROS) | 8.226 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 1.667 | KM Geo Mean | 5.298 |
| KM SD (logged) | 1.017 | 95% Critical H Value (KM-Log) | 2.256 |
| KM Standard Error of Mean (logged) | 0.123 | 95% H-UCL (KM -Log) | 11.74 |
| KM SD (logged) | 1.017 | 95% Critical H Value (KM-Log) | 2.256 |
| KM Standard Error of Mean (logged) | 0.123 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 6.67 | Mean in Log Scale | 1.657 |
| SD in Original Scale | 3.624 | SD in Log Scale | 1.092 |
| 95% t UCL (Assumes normality) | 7.398 | 95% H-Stat UCL | 12.82 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

### Suggested UCL to Use

95% KM (Chebyshev) UCL 8.572

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Total Low-molecular-weight PAHs

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 51 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 67 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 49 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.15 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 6.3 | Maximum Non-Detect | 0.042 |
| Variance Detects | 0.67 | Percent Non-Detects | 2.899% |
| Mean Detects | 0.862 | SD Detects | 0.818 |
| Median Detects | 0.66 | CV Detects | 0.949 |
| Skewness Detects | 4.913 | Kurtosis Detects | 30.15 |
| Mean of Logged Detects | -0.349 | SD of Logged Detects | 0.572 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.549 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.244 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.108 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.837 | KM Standard Error of Mean | 0.0986 |
| KM SD | 0.813 | 95% KM (BCA) UCL | 1.026 |
| 95% KM (t) UCL | 1.002 | 95% KM (Percentile Bootstrap) UCL | 1.011 |
| 95% KM (z) UCL | 0.999 | 95% KM Bootstrap t UCL | 1.134 |
| 90% KM Chebyshev UCL | 1.133 | 95% KM Chebyshev UCL | 1.267 |
| 97.5% KM Chebyshev UCL | 1.453 | 99% KM Chebyshev UCL | 1.819 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 2.606 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.76 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.154 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.11 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.645 | k star (bias corrected MLE) | 2.536 |
| Theta hat (MLE) | 0.326 | Theta star (bias corrected MLE) | 0.34 |
| nu hat (MLE) | 354.4 | nu star (bias corrected) | 339.9 |
| Mean (detects) | 0.862 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.837 |
| Maximum | 6.3 | Median | 0.64 |
| SD | 0.819 | CV | 0.978 |
| k hat (MLE) | 1.844 | k star (bias corrected MLE) | 1.773 |
| Theta hat (MLE) | 0.454 | Theta star (bias corrected MLE) | 0.472 |
| nu hat (MLE) | 254.4 | nu star (bias corrected) | 244.7 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (244.69, α) | 209.5 | Adjusted Chi Square Value (244.69, β) | 208.8 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.978 | 95% Gamma Adjusted UCL (use when n<50) | 0.981 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.837 | SD (KM) | 0.813 |
| Variance (KM) | 0.661 | SE of Mean (KM) | 0.0986 |
| k hat (KM) | 1.06 | k star (KM) | 1.024 |
| nu hat (KM) | 146.3 | nu star (KM) | 141.3 |
| theta hat (KM) | 0.79 | theta star (KM) | 0.818 |
| 80% gamma percentile (KM) | 1.345 | 90% gamma percentile (KM) | 1.917 |
| 95% gamma percentile (KM) | 2.487 | 99% gamma percentile (KM) | 3.81 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (141.30, α) | 114.8 | Adjusted Chi Square Value (141.30, β) | 114.3 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.03 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.035 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.95 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.0211 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.105 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.108 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.842 | Mean in Log Scale | -0.389 |
| SD in Original Scale | 0.814 | SD in Log Scale | 0.609 |
| 95% t UCL (assumes normality of ROS data) | 1.006 | 95% Percentile Bootstrap UCL | 1.012 |
| 95% BCA Bootstrap UCL | 1.098 | 95% Bootstrap t UCL | 1.154 |
| 95% H-UCL (Log ROS) | 0.942 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.484 | KM Geo Mean | 0.616 |
| KM SD (logged) | 0.961 | 95% Critical H Value (KM-Log) | 2.234 |
| KM Standard Error of Mean (logged) | 0.117 | 95% H-UCL (KM -Log) | 1.268 |
| KM SD (logged) | 0.961 | 95% Critical H Value (KM-Log) | 2.234 |
| KM Standard Error of Mean (logged) | 0.117 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.837 | Mean in Log Scale | -0.478 |
| SD in Original Scale | 0.819 | SD in Log Scale | 0.95 |
| 95% t UCL (Assumes normality) | 1.002 | 95% H-Stat UCL | 1.259 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Lognormal Distributed at 5% Significance Level**

**Suggested UCL to Use**

KM H-UCL 1.268

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Total PAHs (sum 16)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 45 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 44 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.25 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 30 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 17.83 | Percent Non-Detects | 1.449% |
| Mean Detects | 7.601 | SD Detects | 4.223 |
| Median Detects | 6.75 | CV Detects | 0.556 |
| Skewness Detects | 2.46 | Kurtosis Detects | 11.04 |
| Mean of Logged Detects | 1.877 | SD of Logged Detects | 0.634 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.828 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 1.127E-10 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.168 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 7.491 | KM Standard Error of Mean | 0.517 |
| KM SD | 4.259 | 95% KM (BCA) UCL | 8.415 |
| 95% KM (t) UCL | 8.352 | 95% KM (Percentile Bootstrap) UCL | 8.379 |
| 95% KM (z) UCL | 8.34 | 95% KM Bootstrap t UCL | 8.561 |
| 90% KM Chebyshev UCL | 9.04 | 95% KM Chebyshev UCL | 9.742 |
| 97.5% KM Chebyshev UCL | 10.72 | 99% KM Chebyshev UCL | 12.63 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.747 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.757 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.169 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.457 | k star (bias corrected MLE) | 3.315 |
| Theta hat (MLE) | 2.198 | Theta star (bias corrected MLE) | 2.293 |
| nu hat (MLE) | 470.2 | nu star (bias corrected) | 450.8 |
| Mean (detects) | 7.601 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.25 | Mean | 7.504 |
| Maximum | 30 | Median | 6.7 |
| SD | 4.267 | CV | 0.569 |
| k hat (MLE) | 3.156 | k star (bias corrected MLE) | 3.029 |
| Theta hat (MLE) | 2.377 | Theta star (bias corrected MLE) | 2.478 |
| nu hat (MLE) | 435.6 | nu star (bias corrected) | 418 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (417.98, α) | 371.6 | Adjusted Chi Square Value (417.98, β) | 370.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 8.441 | 95% Gamma Adjusted UCL (use when n<50) | 8.462 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 7.491 | SD (KM) | 4.259 |
| Variance (KM) | 18.14 | SE of Mean (KM) | 0.517 |
| k hat (KM) | 3.094 | k star (KM) | 2.969 |
| nu hat (KM) | 426.9 | nu star (KM) | 409.7 |
| theta hat (KM) | 2.421 | theta star (KM) | 2.523 |
| 80% gamma percentile (KM) | 10.7 | 90% gamma percentile (KM) | 13.32 |
| 95% gamma percentile (KM) | 15.77 | 99% gamma percentile (KM) | 21.08 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (409.70, α) | 363.8 | Adjusted Chi Square Value (409.70, β) | 362.9 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 8.436 | 95% Gamma Adjusted KM-UCL (use when n<50) | 8.458 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.848 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 2.2745E-9 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.212 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 7.512 | Mean in Log Scale | 1.855 |
| SD in Original Scale | 4.256 | SD in Log Scale | 0.654 |
| 95% t UCL (assumes normality of ROS data) | 8.366 | 95% Percentile Bootstrap UCL | 8.352 |
| 95% BCA Bootstrap UCL | 8.573 | 95% Bootstrap t UCL | 8.597 |
| 95% H-UCL (Log ROS) | 9.263 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | 1.777 | KM Geo Mean | 5.912 |
| KM SD (logged) | 1.033 | 95% Critical H Value (KM-Log) | 2.256 |
| KM Standard Error of Mean (logged) | 0.125 | 95% H-UCL (KM -Log) | 13.37 |
| KM SD (logged) | 1.033 | 95% Critical H Value (KM-Log) | 2.256 |
| KM Standard Error of Mean (logged) | 0.125 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 7.491 | Mean in Log Scale | 1.767 |
| SD in Original Scale | 4.29 | SD in Log Scale | 1.108 |
| 95% t UCL (Assumes normality) | 8.352 | 95% H-Stat UCL | 14.6 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 9.742

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|TCDD TEQ HH

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Minimum | 3.23E-07 | Mean | 4.52E-05 |
| Maximum | 7.07E-04 | Median | 9.1400E-6 |
| SD | 1.2390E-4 | Std. Error of Mean | 1.9350E-5 |
| Coefficient of Variation | N/A | Skewness | 4.507 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.381 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.375 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 7.7816E-5 | 95% Adjusted-CLT UCL (Chen-1995) | 9.1615E-5 |
| | | 95% Modified-t UCL (Johnson-1978) | 8.0086E-5 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 3.287 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.824 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.237 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.147 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.454 | k star (bias corrected MLE) | 0.437 |
| Theta hat (MLE) | 9.9718E-5 | Theta star (bias corrected MLE) | 1.0358E-4 |
| nu hat (MLE) | 37.2 | nu star (bias corrected) | 35.81 |
| MLE Mean (bias corrected) | 4.5235E-5 | MLE Sd (bias corrected) | 6.8451E-5 |
| | | Approximate Chi Square Value (0.05) | 23.11 |
| Adjusted Level of Significance | 0.0441 | Adjusted Chi Square Value | 22.74 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 7.0076E-5 | 95% Adjusted Gamma UCL (use when n<50) | 7.1226E-5 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.971 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.114 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -14.95 | Mean of logged Data | -11.43 |
| Maximum of Logged Data | -7.254 | SD of logged Data | 1.547 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 7.5586E-5 | 90% Chebyshev (MVUE) UCL | 6.6521E-5 |
| 95% Chebyshev (MVUE) UCL | 8.1235E-5 | 97.5% Chebyshev (MVUE) UCL | 1.0166E-4 |
| 99% Chebyshev (MVUE) UCL | 1.4177E-4 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 7.7062E-5 | 95% Jackknife UCL | 7.7816E-5 |
| 95% Standard Bootstrap UCL | 7.5873E-5 | 95% Bootstrap-t UCL | 1.4400E-4 |
| 95% Hall's Bootstrap UCL | 1.7922E-4 | 95% Percentile Bootstrap UCL | 7.8854E-5 |
| 95% BCA Bootstrap UCL | 9.1888E-5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.0328E-4 | 95% Chebyshev(Mean, Sd) UCL | 1.2958E-4 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.6607E-4 | 99% Chebyshev(Mean, Sd) UCL | 2.3776E-4 |

**Suggested UCL to Use**

95% Chebyshev (Mean, Sd) UCL 1.30E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Aluminum

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 48 |
| | | Number of Missing Observations | 1 |
| Minimum | 1900 | Mean | 8417 |
| Maximum | 18000 | Median | 8000 |
| SD | 3409 | Std. Error of Mean | 372 |
| Coefficient of Variation | 0.405 | Skewness | 0.334 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.975 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.347 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0732 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 9035 | 95% Adjusted-CLT UCL (Chen-1995) | 9043 |
| | | 95% Modified-t UCL (Johnson-1978) | 9038 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.413 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.754 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0596 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0977 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.404 | k star (bias corrected MLE) | 5.219 |
| Theta hat (MLE) | 1558 | Theta star (bias corrected MLE) | 1613 |
| nu hat (MLE) | 907.8 | nu star (bias corrected) | 876.7 |
| MLE Mean (bias corrected) | 8417 | MLE Sd (bias corrected) | 3684 |
| | | Approximate Chi Square Value (0.05) | 809 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 807.9 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 9121 | 95% Adjusted Gamma UCL (use when n<50) | 9134 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.936 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 4.8526E-4 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0796 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 7.55 | Mean of logged Data | 8.943 |
| Maximum of Logged Data | 9.798 | SD of logged Data | 0.469 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 9384 | 90% Chebyshev (MVUE) UCL | 9903 |
| 95% Chebyshev (MVUE) UCL | 10525 | 97.5% Chebyshev (MVUE) UCL | 11389 |
| 99% Chebyshev (MVUE) UCL | 13085 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 9028 | 95% Jackknife UCL | 9035 |
| 95% Standard Bootstrap UCL | 9000 | 95% Bootstrap-t UCL | 9064 |
| 95% Hall's Bootstrap UCL | 9053 | 95% Percentile Bootstrap UCL | 9063 |
| 95% BCA Bootstrap UCL | 9023 | | |
| 90% Chebyshev(Mean, Sd) UCL | 9533 | 95% Chebyshev(Mean, Sd) UCL | 10038 |
| 97.5% Chebyshev(Mean, Sd) UCL | 10740 | 99% Chebyshev(Mean, Sd) UCL | 12118 |

**Suggested UCL to Use**

95% Student's-t UCL 9035

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Antimony

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 52 |
| | | Number of Missing Observations | 1 |
| Number of Detects | 83 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 52 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.05 | Minimum Non-Detect | 0.2 |
| Maximum Detect | 43 | Maximum Non-Detect | 0.2 |
| Variance Detects | 21.82 | Percent Non-Detects | 1.19% |
| Mean Detects | 1.216 | SD Detects | 4.671 |
| Median Detects | 0.55 | CV Detects | 3.842 |
| Skewness Detects | 8.942 | Kurtosis Detects | 80.89 |
| Mean of Logged Detects | -0.515 | SD of Logged Detects | 0.826 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.177 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.411 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0974 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 1.203 | KM Standard Error of Mean | 0.507 |
| KM SD | 4.617 | 95% KM (BCA) UCL | 2.255 |
| 95% KM (t) UCL | 2.046 | 95% KM (Percentile Bootstrap) UCL | 2.186 |
| 95% KM (z) UCL | 2.037 | 95% KM Bootstrap t UCL | 7.113 |
| 90% KM Chebyshev UCL | 2.723 | 95% KM Chebyshev UCL | 3.412 |
| 97.5% KM Chebyshev UCL | 4.368 | 99% KM Chebyshev UCL | 6.245 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 9.457 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.79 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.244 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.102 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.831 | k star (bias corrected MLE) | 0.809 |
| Theta hat (MLE) | 1.463 | Theta star (bias corrected MLE) | 1.503 |
| nu hat (MLE) | 137.9 | nu star (bias corrected) | 134.3 |
| Mean (detects) | 1.216 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 1.201 |
| Maximum | 43 | Median | 0.54 |
| SD | 4.645 | CV | 3.866 |
| k hat (MLE) | 0.795 | k star (bias corrected MLE) | 0.774 |
| Theta hat (MLE) | 1.512 | Theta star (bias corrected MLE) | 1.552 |
| nu hat (MLE) | 133.5 | nu star (bias corrected) | 130 |
| Adjusted Level of Significance (β) | 0.0471 | | |
| Approximate Chi Square Value (130.05, α) | 104.7 | Adjusted Chi Square Value (130.05, β) | 104.3 |
| 95% Gamma Approximate UCL (use when n>=50) | 1.492 | 95% Gamma Adjusted UCL (use when n<50) | 1.498 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 1.203 | SD (KM) | 4.617 |
| Variance (KM) | 21.31 | SE of Mean (KM) | 0.507 |
| k hat (KM) | 0.0679 | k star (KM) | 0.0734 |
| nu hat (KM) | 11.41 | nu star (KM) | 12.33 |
| theta hat (KM) | 17.72 | theta star (KM) | 16.39 |
| 80% gamma percentile (KM) | 0.479 | 90% gamma percentile (KM) | 2.691 |
| 95% gamma percentile (KM) | 6.954 | 99% gamma percentile (KM) | 22.18 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (12.33, α) | 5.446 | Adjusted Chi Square Value (12.33, β) | 5.366 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 2.724 | 95% Gamma Adjusted KM-UCL (use when n<50) | 2.764 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.91 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 3.0373E-6 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.102 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0974 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.203 | Mean in Log Scale | -0.533 |
| SD in Original Scale | 4.644 | SD in Log Scale | 0.836 |
| 95% t UCL (assumes normality of ROS data) | 2.046 | 95% Percentile Bootstrap UCL | 2.207 |
| 95% BCA Bootstrap UCL | 2.805 | 95% Bootstrap t UCL | 7.215 |
| 95% H-UCL (Log ROS) | 1.008 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.535 | KM Geo Mean | 0.586 |
| KM SD (logged) | 0.836 | 95% Critical H Value (KM-Log) | 2.086 |
| KM Standard Error of Mean (logged) | 0.0919 | 95% H-UCL (KM -Log) | 1.006 |
| KM SD (logged) | 0.836 | 95% Critical H Value (KM-Log) | 2.086 |
| KM Standard Error of Mean (logged) | 0.0919 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.203 | Mean in Log Scale | -0.537 |
| SD in Original Scale | 4.645 | SD in Log Scale | 0.844 |
| 95% t UCL (Assumes normality) | 2.046 | 95% H-Stat UCL | 1.013 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 3.412

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Barium

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 46 |
| | | Number of Missing Observations | 1 |
| Minimum | 17 | Mean | 84.43 |
| Maximum | 180 | Median | 84.5 |
| SD | 28.95 | Std. Error of Mean | 3.158 |
| Coefficient of Variation | 0.343 | Skewness | 0.335 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.987 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.876 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0692 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

### Assuming Normal Distribution

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 89.69 | 95% Adjusted-CLT UCL (Chen-1995) | 89.75 |
| | | 95% Modified-t UCL (Johnson-1978) | 89.71 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.596 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.753 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0658 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0976 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 7.578 | k star (bias corrected MLE) | 7.315 |
| Theta hat (MLE) | 11.14 | Theta star (bias corrected MLE) | 11.54 |
| nu hat (MLE) | 1273 | nu star (bias corrected) | 1229 |
| MLE Mean (bias corrected) | 84.43 | MLE Sd (bias corrected) | 31.22 |
| | | Approximate Chi Square Value (0.05) | 1149 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 1147 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 90.34 | 95% Adjusted Gamma UCL (use when n<50) | 90.45 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.00108 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0865 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.833 | Mean of logged Data | 4.369 |
| Maximum of Logged Data | 5.193 | SD of logged Data | 0.394 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 92.13 | 90% Chebyshev (MVUE) UCL | 96.56 |
| 95% Chebyshev (MVUE) UCL | 101.7 | 97.5% Chebyshev (MVUE) UCL | 108.8 |
| 99% Chebyshev (MVUE) UCL | 122.9 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 89.63 | 95% Jackknife UCL | 89.69 |
| 95% Standard Bootstrap UCL | 89.49 | 95% Bootstrap-t UCL | 89.78 |
| 95% Hall's Bootstrap UCL | 89.63 | 95% Percentile Bootstrap UCL | 89.64 |
| 95% BCA Bootstrap UCL | 89.49 | | |
| 90% Chebyshev(Mean, Sd) UCL | 93.91 | 95% Chebyshev(Mean, Sd) UCL | 98.2 |
| 97.5% Chebyshev(Mean, Sd) UCL | 104.2 | 99% Chebyshev(Mean, Sd) UCL | 115.9 |

### Suggested UCL to Use

95% Student's-t UCL 89.69

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Beryllium

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 84 | Number of Distinct Observations | 42 |
| | | Number of Missing Observations | 1 |
| Minimum | 0.15 | Mean | 1.069 |
| Maximum | 2.2 | Median | 1 |
| SD | 0.403 | Std. Error of Mean | 0.044 |
| Coefficient of Variation | 0.377 | Skewness | 0.288 |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.978 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk P Value | 0.476 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.113 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level | |
| Data appear Approximate Normal at 5% Significance Level | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.143 | 95% Adjusted-CLT UCL (Chen-1995) | 1.143 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.143 |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.621 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.754 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.0855 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.0977 | Detected data appear Gamma Distributed at 5% Significance Level | |
| Detected data appear Gamma Distributed at 5% Significance Level | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 6.124 | k star (bias corrected MLE) | 5.913 |
| Theta hat (MLE) | 0.175 | Theta star (bias corrected MLE) | 0.181 |
| nu hat (MLE) | 1029 | nu star (bias corrected) | 993.4 |
| MLE Mean (bias corrected) | 1.069 | MLE Sd (bias corrected) | 0.44 |
| | | Approximate Chi Square Value (0.05) | 921.3 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 920.1 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 1.153 | 95% Adjusted Gamma UCL (use when n<50) | 1.155 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.931 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk P Value | 1.8785E-4 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.115 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level | |
| Data Not Lognormal at 5% Significance Level | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | -1.897 | Mean of logged Data | -0.0169 |
| Maximum of Logged Data | 0.788 | SD of logged Data | 0.445 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 1.186 | 90% Chebyshev (MVUE) UCL | 1.249 |
| 95% Chebyshev (MVUE) UCL | 1.323 | 97.5% Chebyshev (MVUE) UCL | 1.427 |
| 99% Chebyshev (MVUE) UCL | 1.63 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| Data appear to follow a Discernible Distribution at 5% Significance Level | | | |

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.142 | 95% Jackknife UCL | 1.143 |
| 95% Standard Bootstrap UCL | 1.143 | 95% Bootstrap-t UCL | 1.149 |
| 95% Hall's Bootstrap UCL | 1.144 | 95% Percentile Bootstrap UCL | 1.143 |
| 95% BCA Bootstrap UCL | 1.142 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.201 | 95% Chebyshev(Mean, Sd) UCL | 1.261 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.344 | 99% Chebyshev(Mean, Sd) UCL | 1.507 |

### Suggested UCL to Use

95% Student's-t UCL 1.143

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Chromium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 44 |
| | | Number of Missing Observations | 1 |
| Minimum | 11 | Mean | 39.15 |
| Maximum | 140 | Median | 37 |
| SD | 18.68 | Std. Error of Mean | 2.038 |
| Coefficient of Variation | 0.477 | Skewness | 2.118 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.874 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 1.1131E-9 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.108 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 42.54 | 95% Adjusted-CLT UCL (Chen-1995) | 43 |
| | | 95% Modified-t UCL (Johnson-1978) | 42.62 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.377 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.754 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0817 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0977 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.222 | k star (bias corrected MLE) | 5.043 |
| Theta hat (MLE) | 7.498 | Theta star (bias corrected MLE) | 7.763 |
| nu hat (MLE) | 877.2 | nu star (bias corrected) | 847.2 |
| MLE Mean (bias corrected) | 39.15 | MLE Sd (bias corrected) | 17.43 |
| | | Approximate Chi Square Value (0.05) | 780.7 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 779.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 42.49 | 95% Adjusted Gamma UCL (use when n<50) | 42.55 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.981 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.62 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0861 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.398 | Mean of logged Data | 3.569 |
| Maximum of Logged Data | 4.942 | SD of logged Data | 0.451 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 42.96 | 90% Chebyshev (MVUE) UCL | 45.26 |
| 95% Chebyshev (MVUE) UCL | 48 | 97.5% Chebyshev (MVUE) UCL | 51.8 |
| 99% Chebyshev (MVUE) UCL | 59.26 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 42.5 | 95% Jackknife UCL | 42.54 |
| 95% Standard Bootstrap UCL | 42.45 | 95% Bootstrap-t UCL | 43.21 |
| 95% Hall's Bootstrap UCL | 43.63 | 95% Percentile Bootstrap UCL | 42.55 |
| 95% BCA Bootstrap UCL | 42.93 | | |
| 90% Chebyshev(Mean, Sd) UCL | 45.26 | 95% Chebyshev(Mean, Sd) UCL | 48.03 |
| 97.5% Chebyshev(Mean, Sd) UCL | 51.88 | 99% Chebyshev(Mean, Sd) UCL | 59.43 |

### Suggested UCL to Use

95% Approximate Gamma UCL 42.49

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Iron

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 27 |
| | | Number of Missing Observations | 1 |
| Minimum | 7500 | Mean | 20855 |
| Maximum | 34000 | Median | 20500 |
| SD | 6624 | Std. Error of Mean | 722.8 |
| Coefficient of Variation | 0.318 | Skewness | 0.0458 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.957 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.0252 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.113 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 22057 | 95% Adjusted-CLT UCL (Chen-1995) | 22047 |
| | | 95% Modified-t UCL (Johnson-1978) | 22058 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.755 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.752 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.107 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0975 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 9.085 | k star (bias corrected MLE) | 8.769 |
| Theta hat (MLE) | 2295 | Theta star (bias corrected MLE) | 2378 |
| nu hat (MLE) | 1526 | nu star (bias corrected) | 1473 |
| MLE Mean (bias corrected) | 20855 | MLE Sd (bias corrected) | 7043 |
| | | Approximate Chi Square Value (0.05) | 1385 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 1384 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 22182 | 95% Adjusted Gamma UCL (use when n<50) | 22205 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.938 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 7.1593E-4 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.108 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 8.923 | Mean of logged Data | 9.889 |
| Maximum of Logged Data | 10.43 | SD of logged Data | 0.35 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 22435 | 90% Chebyshev (MVUE) UCL | 23415 |
| 95% Chebyshev (MVUE) UCL | 24532 | 97.5% Chebyshev (MVUE) UCL | 26083 |
| 99% Chebyshev (MVUE) UCL | 29129 | | |

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution (0.05)

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 22044 | 95% Jackknife UCL | 22057 |
| 95% Standard Bootstrap UCL | 22059 | 95% Bootstrap-t UCL | 22115 |
| 95% Hall's Bootstrap UCL | 22105 | 95% Percentile Bootstrap UCL | 22049 |
| 95% BCA Bootstrap UCL | 22048 | | |
| 90% Chebyshev(Mean, Sd) UCL | 23023 | 95% Chebyshev(Mean, Sd) UCL | 24005 |
| 97.5% Chebyshev(Mean, Sd) UCL | 25368 | 99% Chebyshev(Mean, Sd) UCL | 28046 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 22057 | or 95% Modified-t UCL | 22058 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Manganese

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 1 |
| Minimum | 86 | Mean | 274.1 |
| Maximum | 590 | Median | 245 |
| SD | 126.5 | Std. Error of Mean | 13.8 |
| Coefficient of Variation | 0.461 | Skewness | 0.677 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.928 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 9.9675E-5 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 297.1 | 95% Adjusted-CLT UCL (Chen-1995) | 297.9 |
| | | 95% Modified-t UCL (Johnson-1978) | 297.3 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.444 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.755 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0854 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0978 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.809 | k star (bias corrected MLE) | 4.646 |
| Theta hat (MLE) | 57 | Theta star (bias corrected MLE) | 59.01 |
| nu hat (MLE) | 808 | nu star (bias corrected) | 780.5 |
| MLE Mean (bias corrected) | 274.1 | MLE Sd (bias corrected) | 127.2 |
| | | Approximate Chi Square Value (0.05) | 716.6 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 715.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 298.6 | 95% Adjusted Gamma UCL (use when n<50) | 299 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.964 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.0801 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0661 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 4.454 | Mean of logged Data | 5.506 |
| Maximum of Logged Data | 6.38 | SD of logged Data | 0.475 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 303.2 | 90% Chebyshev (MVUE) UCL | 320.1 |
| 95% Chebyshev (MVUE) UCL | 340.4 | 97.5% Chebyshev (MVUE) UCL | 368.6 |
| 99% Chebyshev (MVUE) UCL | 424.1 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 296.8 | 95% Jackknife UCL | 297.1 |
| 95% Standard Bootstrap UCL | 296.5 | 95% Bootstrap-t UCL | 297.5 |
| 95% Hall's Bootstrap UCL | 298 | 95% Percentile Bootstrap UCL | 297.7 |
| 95% BCA Bootstrap UCL | 297.1 | | |
| 90% Chebyshev(Mean, Sd) UCL | 315.5 | 95% Chebyshev(Mean, Sd) UCL | 334.3 |
| 97.5% Chebyshev(Mean, Sd) UCL | 360.3 | 99% Chebyshev(Mean, Sd) UCL | 411.4 |

**Suggested UCL to Use**

95% Approximate Gamma UCL 298.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Thallium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 29 |
| | | Number of Missing Observations | 1 |
| Minimum | 0.037 | Mean | 0.201 |
| Maximum | 0.63 | Median | 0.19 |
| SD | 0.0852 | Std. Error of Mean | 0.00929 |
| Coefficient of Variation | 0.423 | Skewness | 2.102 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.856 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 2.382E-11 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.118 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.217 | 95% Adjusted-CLT UCL (Chen-1995) | 0.219 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.217 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.157 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.754 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0975 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0977 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.298 | k star (bias corrected MLE) | 6.081 |
| Theta hat (MLE) | 0.032 | Theta star (bias corrected MLE) | 0.0331 |
| nu hat (MLE) | 1058 | nu star (bias corrected) | 1022 |
| MLE Mean (bias corrected) | 0.201 | MLE Sd (bias corrected) | 0.0816 |
| | | Approximate Chi Square Value (0.05) | 948.5 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 947.2 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.217 | 95% Adjusted Gamma UCL (use when n<50) | 0.217 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.00113 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.104 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.297 | Mean of logged Data | -1.685 |
| Maximum of Logged Data | -0.462 | SD of logged Data | 0.42 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.22 | 90% Chebyshev (MVUE) UCL | 0.231 |
| 95% Chebyshev (MVUE) UCL | 0.244 | 97.5% Chebyshev (MVUE) UCL | 0.263 |
| 99% Chebyshev (MVUE) UCL | 0.298 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.217 | 95% Jackknife UCL | 0.217 |
| 95% Standard Bootstrap UCL | 0.216 | 95% Bootstrap-t UCL | 0.22 |
| 95% Hall's Bootstrap UCL | 0.222 | 95% Percentile Bootstrap UCL | 0.217 |
| 95% BCA Bootstrap UCL | 0.217 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.229 | 95% Chebyshev(Mean, Sd) UCL | 0.242 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.259 | 99% Chebyshev(Mean, Sd) UCL | 0.294 |

**Suggested UCL to Use**

95% Approximate Gamma UCL 0.217

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_Metals|Vanadium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 51 |
| | | Number of Missing Observations | 1 |
| Minimum | 8.5 | Mean | 60.14 |
| Maximum | 440 | Median | 37 |
| SD | 69 | Std. Error of Mean | 7.529 |
| Coefficient of Variation | 1.147 | Skewness | 3.511 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.59 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.286 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 72.67 | 95% Adjusted-CLT UCL (Chen-1995) | 75.61 |
| | | 95% Modified-t UCL (Johnson-1978) | 73.15 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 5.073 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.769 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.226 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.0992 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.651 | k star (bias corrected MLE) | 1.6 |
| Theta hat (MLE) | 36.43 | Theta star (bias corrected MLE) | 37.59 |
| nu hat (MLE) | 277.3 | nu star (bias corrected) | 268.8 |
| MLE Mean (bias corrected) | 60.14 | MLE Sd (bias corrected) | 47.55 |
| | | Approximate Chi Square Value (0.05) | 231.8 |
| Adjusted Level of Significance | 0.0471 | Adjusted Chi Square Value | 231.2 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 69.74 | 95% Adjusted Gamma UCL (use when n<50) | 69.91 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.928 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 9.1018E-5 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.168 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.0968 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.14 | Mean of logged Data | 3.764 |
| Maximum of Logged Data | 6.087 | SD of logged Data | 0.736 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 66.64 | 90% Chebyshev (MVUE) UCL | 71.45 |
| 95% Chebyshev (MVUE) UCL | 78.29 | 97.5% Chebyshev (MVUE) UCL | 87.79 |
| 99% Chebyshev (MVUE) UCL | 106.5 | | |

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution (0.05)

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 72.53 | 95% Jackknife UCL | 72.67 |
| 95% Standard Bootstrap UCL | 72.43 | 95% Bootstrap-t UCL | 79.67 |
| 95% Hall's Bootstrap UCL | 77.6 | 95% Percentile Bootstrap UCL | 72.77 |
| 95% BCA Bootstrap UCL | 75.84 | | |
| 90% Chebyshev(Mean, Sd) UCL | 82.73 | 95% Chebyshev(Mean, Sd) UCL | 92.96 |
| 97.5% Chebyshev(Mean, Sd) UCL | 107.2 | 99% Chebyshev(Mean, Sd) UCL | 135.1 |

**Suggested UCL to Use**

95% Chebyshev (Mean, Sd) UCL 92.96

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Aroclor-1248

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 64 |
| | | Number of Missing Observations | 1 |
| Number of Detects | 71 | Number of Non-Detects | 13 |
| Number of Distinct Detects | 51 | Number of Distinct Non-Detects | 13 |
| Minimum Detect | 0.015 | Minimum Non-Detect | 0.0018 |
| Maximum Detect | 0.89 | Maximum Non-Detect | 0.011 |
| Variance Detects | 0.0362 | Percent Non-Detects | 15.48% |
| Mean Detects | 0.176 | SD Detects | 0.19 |
| Median Detects | 0.1 | CV Detects | 1.084 |
| Skewness Detects | 2.084 | Kurtosis Detects | 4.276 |
| Mean of Logged Detects | -2.181 | SD of Logged Detects | 0.917 |

| Normal GOF Test on Detects Only | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.723 | Normal GOF Test on Detected Observations Only |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.258 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.105 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.149 | KM Standard Error of Mean | 0.0203 |
| KM SD | 0.185 | 95% KM (BCA) UCL | 0.183 |
| 95% KM (t) UCL | 0.182 | 95% KM (Percentile Bootstrap) UCL | 0.184 |
| 95% KM (z) UCL | 0.182 | 95% KM Bootstrap t UCL | 0.191 |
| 90% KM Chebyshev UCL | 0.21 | 95% KM Chebyshev UCL | 0.237 |
| 97.5% KM Chebyshev UCL | 0.275 | 99% KM Chebyshev UCL | 0.351 |

| Gamma GOF Tests on Detected Observations Only | | |
|---|---|---|
| A-D Test Statistic | 2.281 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.774 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.169 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.108 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 1.274 | k star (bias corrected MLE) | 1.23 |
| Theta hat (MLE) | 0.138 | Theta star (bias corrected MLE) | 0.143 |
| nu hat (MLE) | 180.9 | nu star (bias corrected) | 174.6 |
| Mean (detects) | 0.176 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.15 |
| Maximum | 0.89 | Median | 0.0765 |
| SD | 0.185 | CV | 1.233 |
| k hat (MLE) | 0.889 | k star (bias corrected MLE) | 0.865 |
| Theta hat (MLE) | 0.169 | Theta star (bias corrected MLE) | 0.173 |
| nu hat (MLE) | 149.4 | nu star (bias corrected) | 145.4 |
| Adjusted Level of Significance (β) | 0.0471 | | |
| Approximate Chi Square Value (145.36, α) | 118.5 | Adjusted Chi Square Value (145.36, β) | 118.1 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.184 | 95% Gamma Adjusted UCL (use when n<50) | 0.185 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.149 | SD (KM) | 0.185 |
| Variance (KM) | 0.0341 | SE of Mean (KM) | 0.0203 |
| k hat (KM) | 0.648 | k star (KM) | 0.632 |
| nu hat (KM) | 108.8 | nu star (KM) | 106.2 |
| theta hat (KM) | 0.23 | theta star (KM) | 0.235 |
| 80% gamma percentile (KM) | 0.245 | 90% gamma percentile (KM) | 0.382 |
| 95% gamma percentile (KM) | 0.525 | 99% gamma percentile (KM) | 0.869 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (106.23, α) | 83.45 | Adjusted Chi Square Value (106.23, β) | 83.1 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.189 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.19 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.959 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.0636 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.101 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.105 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.151 | Mean in Log Scale | -2.492 |
| SD in Original Scale | 0.184 | SD in Log Scale | 1.114 |
| 95% t UCL (assumes normality of ROS data) | 0.184 | 95% Percentile Bootstrap UCL | 0.185 |
| 95% BCA Bootstrap UCL | 0.19 | 95% Bootstrap t UCL | 0.192 |
| 95% H-UCL (Log ROS) | 0.205 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.822 | KM Geo Mean | 0.0595 |
| KM SD (logged) | 1.715 | 95% Critical H Value (KM-Log) | 3.018 |
| KM Standard Error of Mean (logged) | 0.188 | 95% H-UCL (KM -Log) | 0.457 |
| KM SD (logged) | 1.715 | 95% Critical H Value (KM-Log) | 3.018 |
| KM Standard Error of Mean (logged) | 0.188 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 0.149 | Mean in Log Scale | -2.762 |
| SD in Original Scale | 0.186 | SD in Log Scale | 1.62 |
| 95% t UCL (Assumes normality) | 0.183 | 95% H-Stat UCL | 0.393 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

KM H-UCL 0.457

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Aroclor-1254

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 62 |
| | | Number of Missing Observations | 1 |
| Number of Detects | 21 | Number of Non-Detects | 63 |
| Number of Distinct Detects | 17 | Number of Distinct Non-Detects | 45 |
| Minimum Detect | 0.019 | Minimum Non-Detect | 1.2000E-4 |
| Maximum Detect | 0.25 | Maximum Non-Detect | 0.013 |
| Variance Detects | 0.00518 | Percent Non-Detects | 75% |
| Mean Detects | 0.1 | SD Detects | 0.072 |
| Median Detects | 0.081 | CV Detects | 0.718 |
| Skewness Detects | 0.898 | Kurtosis Detects | -0.208 |
| Mean of Logged Detects | -2.569 | SD of Logged Detects | 0.784 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.889 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.171 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Approximate Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.0251 | KM Standard Error of Mean | 0.00624 |
| KM SD | 0.0558 | 95% KM (BCA) UCL | 0.0356 |
| 95% KM (t) UCL | 0.0355 | 95% KM (Percentile Bootstrap) UCL | 0.035 |
| 95% KM (z) UCL | 0.0354 | 95% KM Bootstrap t UCL | 0.0373 |
| 90% KM Chebyshev UCL | 0.0439 | 95% KM Chebyshev UCL | 0.0523 |
| 97.5% KM Chebyshev UCL | 0.0641 | 99% KM Chebyshev UCL | 0.0872 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.314 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.754 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.118 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.192 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.013 | k star (bias corrected MLE) | 1.757 |
| Theta hat (MLE) | 0.0498 | Theta star (bias corrected MLE) | 0.0571 |
| nu hat (MLE) | 84.53 | nu star (bias corrected) | 73.79 |
| Mean (detects) | 0.1 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.0326 |
| Maximum | 0.25 | Median | 0.01 |
| SD | 0.0529 | CV | 1.623 |
| k hat (MLE) | 0.874 | k star (bias corrected MLE) | 0.851 |
| Theta hat (MLE) | 0.0373 | Theta star (bias corrected MLE) | 0.0383 |
| nu hat (MLE) | 146.8 | nu star (bias corrected) | 142.9 |
| Adjusted Level of Significance (β) | 0.0471 | | |
| Approximate Chi Square Value (142.92, α) | 116.3 | Adjusted Chi Square Value (142.92, β) | 115.9 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.04 | 95% Gamma Adjusted UCL (use when n<50) | 0.0402 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0251 | SD (KM) | 0.0558 |
| Variance (KM) | 0.00311 | SE of Mean (KM) | 0.00624 |
| k hat (KM) | 0.203 | k star (KM) | 0.204 |
| nu hat (KM) | 34.14 | nu star (KM) | 34.25 |
| theta hat (KM) | 0.124 | theta star (KM) | 0.123 |
| 80% gamma percentile (KM) | 0.0335 | 90% gamma percentile (KM) | 0.0761 |
| 95% gamma percentile (KM) | 0.129 | 99% gamma percentile (KM) | 0.274 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (34.25, α) | 21.87 | Adjusted Chi Square Value (34.25, β) | 21.69 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0394 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0397 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.956 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.115 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0294 | Mean in Log Scale | -4.586 |
| SD in Original Scale | 0.0543 | SD in Log Scale | 1.304 |
| 95% t UCL (assumes normality of ROS data) | 0.0393 | 95% Percentile Bootstrap UCL | 0.0394 |
| 95% BCA Bootstrap UCL | 0.0413 | 95% Bootstrap t UCL | 0.0417 |
| 95% H-UCL (Log ROS) | 0.0343 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -7.413 | KM Geo Mean | 6.0324E-4 |
| KM SD (logged) | 2.823 | 95% Critical H Value (KM-Log) | 4.446 |
| KM Standard Error of Mean (logged) | 0.316 | 95% H-UCL (KM -Log) | 0.129 |
| KM SD (logged) | 2.823 | 95% Critical H Value (KM-Log) | 4.446 |
| KM Standard Error of Mean (logged) | 0.316 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0274 | Mean in Log Scale | -5.234 |
| SD in Original Scale | 0.0551 | SD in Log Scale | 1.859 |
| 95% t UCL (Assumes normality) | 0.0374 | 95% H-Stat UCL | 0.0575 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Normal Distributed at 5% Significance Level**

**Suggested UCL to Use**

95% KM (t) UCL 0.0355

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Aroclor-1260

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 84 | Number of Distinct Observations | 61 |
| | | Number of Missing Observations | 1 |
| Number of Detects | 83 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 60 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.0031 | Minimum Non-Detect | 0.0084 |
| Maximum Detect | 1 | Maximum Non-Detect | 0.0084 |
| Variance Detects | 0.0347 | Percent Non-Detects | 1.19% |
| Mean Detects | 0.134 | SD Detects | 0.186 |
| Median Detects | 0.059 | CV Detects | 1.395 |
| Skewness Detects | 2.91 | Kurtosis Detects | 9.77 |
| Mean of Logged Detects | -2.662 | SD of Logged Detects | 1.122 |

| Normal GOF Test on Detects Only | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.639 | Normal GOF Test on Detected Observations Only |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.261 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.0974 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.132 | KM Standard Error of Mean | 0.0203 |
| KM SD | 0.185 | 95% KM (BCA) UCL | 0.167 |
| 95% KM (t) UCL | 0.166 | 95% KM (Percentile Bootstrap) UCL | 0.166 |
| 95% KM (z) UCL | 0.165 | 95% KM Bootstrap t UCL | 0.177 |
| 90% KM Chebyshev UCL | 0.193 | 95% KM Chebyshev UCL | 0.22 |
| 97.5% KM Chebyshev UCL | 0.259 | 99% KM Chebyshev UCL | 0.334 |

| Gamma GOF Tests on Detected Observations Only | | |
|---|---|---|
| A-D Test Statistic | 2.607 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.787 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.139 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.101 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 0.901 | k star (bias corrected MLE) | 0.877 |
| Theta hat (MLE) | 0.148 | Theta star (bias corrected MLE) | 0.152 |
| nu hat (MLE) | 149.6 | nu star (bias corrected) | 145.5 |
| Mean (detects) | 0.134 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0031 | Mean | 0.132 |
| Maximum | 1 | Median | 0.059 |
| SD | 0.186 | CV | 1.406 |
| k hat (MLE) | 0.887 | k star (bias corrected MLE) | 0.863 |
| Theta hat (MLE) | 0.149 | Theta star (bias corrected MLE) | 0.153 |
| nu hat (MLE) | 148.9 | nu star (bias corrected) | 145 |
| Adjusted Level of Significance (β) | 0.0471 | | |
| Approximate Chi Square Value (144.95, α) | 118.1 | Adjusted Chi Square Value (144.95, β) | 117.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.162 | 95% Gamma Adjusted UCL (use when n<50) | 0.163 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.132 | SD (KM) | 0.185 |
| Variance (KM) | 0.0341 | SE of Mean (KM) | 0.0203 |
| k hat (KM) | 0.511 | k star (KM) | 0.501 |
| nu hat (KM) | 85.88 | nu star (KM) | 84.14 |
| theta hat (KM) | 0.258 | theta star (KM) | 0.264 |
| 80% gamma percentile (KM) | 0.217 | 90% gamma percentile (KM) | 0.357 |
| 95% gamma percentile (KM) | 0.507 | 99% gamma percentile (KM) | 0.875 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (84.14, α) | 64 | Adjusted Chi Square Value (84.14, β) | 63.7 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.174 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.174 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.975 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.362 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0802 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.0974 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.132 | Mean in Log Scale | -2.694 |
| SD in Original Scale | 0.186 | SD in Log Scale | 1.154 |
| 95% t UCL (assumes normality of ROS data) | 0.166 | 95% Percentile Bootstrap UCL | 0.165 |
| 95% BCA Bootstrap UCL | 0.173 | 95% Bootstrap t UCL | 0.176 |
| 95% H-UCL (Log ROS) | 0.178 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.699 | KM Geo Mean | 0.0673 |
| KM SD (logged) | 1.159 | 95% Critical H Value (KM-Log) | 2.393 |
| KM Standard Error of Mean (logged) | 0.127 | 95% H-UCL (KM -Log) | 0.179 |
| KM SD (logged) | 1.159 | 95% Critical H Value (KM-Log) | 2.393 |
| KM Standard Error of Mean (logged) | 0.127 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 0.132 | Mean in Log Scale | -2.695 |
| SD in Original Scale | 0.186 | SD in Log Scale | 1.157 |
| 95% t UCL (Assumes normality) | 0.166 | 95% H-Stat UCL | 0.179 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

KM H-UCL 0.179

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Endosulfan Sulfate

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 48 | Number of Distinct Observations | 33 |
| | | Number of Missing Observations | 37 |
| Number of Detects | 30 | Number of Non-Detects | 18 |
| Number of Distinct Detects | 24 | Number of Distinct Non-Detects | 12 |
| Minimum Detect | 1.7000E-4 | Minimum Non-Detect | 4.5000E-5 |
| Maximum Detect | 0.011 | Maximum Non-Detect | 0.0012 |
| Variance Detects | 6.6352E-6 | Percent Non-Detects | 37.5% |
| Mean Detects | 0.00211 | SD Detects | 0.00258 |
| Median Detects | 0.0011 | CV Detects | 1.218 |
| Skewness Detects | 2.504 | Kurtosis Detects | 6.529 |
| Mean of Logged Detects | -6.697 | SD of Logged Detects | 1.057 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.674 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.261 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.00145 | KM Standard Error of Mean | 3.2304E-4 |
| KM SD | 0.00219 | 95% KM (BCA) UCL | 0.00203 |
| 95% KM (t) UCL | 0.00199 | 95% KM (Percentile Bootstrap) UCL | 0.00201 |
| 95% KM (z) UCL | 0.00198 | 95% KM Bootstrap t UCL | 0.00236 |
| 90% KM Chebyshev UCL | 0.00241 | 95% KM Chebyshev UCL | 0.00285 |
| 97.5% KM Chebyshev UCL | 0.00346 | 99% KM Chebyshev UCL | 0.00466 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.735 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.774 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.167 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.165 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.065 | k star (bias corrected MLE) | 0.981 |
| Theta hat (MLE) | 0.00199 | Theta star (bias corrected MLE) | 0.00216 |
| nu hat (MLE) | 63.89 | nu star (bias corrected) | 58.84 |
| Mean (detects) | 0.00211 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.7000E-4 | Mean | 0.00507 |
| Maximum | 0.011 | Median | 0.00323 |
| SD | 0.00436 | CV | 0.859 |
| k hat (MLE) | 0.927 | k star (bias corrected MLE) | 0.883 |
| Theta hat (MLE) | 0.00547 | Theta star (bias corrected MLE) | 0.00574 |
| nu hat (MLE) | 88.98 | nu star (bias corrected) | 84.75 |
| Adjusted Level of Significance (β) | 0.045 | | |
| Approximate Chi Square Value (84.75, α) | 64.53 | Adjusted Chi Square Value (84.75, β) | 63.98 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00666 | 95% Gamma Adjusted UCL (use when n<50) | 0.00672 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00145 | SD (KM) | 0.00219 |
| Variance (KM) | 4.7943E-6 | SE of Mean (KM) | 3.2304E-4 |
| k hat (KM) | 0.436 | k star (KM) | 0.422 |
| nu hat (KM) | 41.82 | nu star (KM) | 40.54 |
| theta hat (KM) | 0.00332 | theta star (KM) | 0.00342 |
| 80% gamma percentile (KM) | 0.00235 | 90% gamma percentile (KM) | 0.00404 |
| 95% gamma percentile (KM) | 0.00589 | 99% gamma percentile (KM) | 0.0105 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (40.54, α) | 26.95 | Adjusted Chi Square Value (40.54, β) | 26.6 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.00217 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0022 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.971 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.104 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00144 | Mean in Log Scale | -7.297 |
| SD in Original Scale | 0.00221 | SD in Log Scale | 1.208 |
| 95% t UCL (assumes normality of ROS data) | 0.00197 | 95% Percentile Bootstrap UCL | 0.002 |
| 95% BCA Bootstrap UCL | 0.00211 | 95% Bootstrap t UCL | 0.00238 |
| 95% H-UCL (Log ROS) | 0.00221 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -7.433 | KM Geo Mean | 5.9142E-4 |
| KM SD (logged) | 1.463 | 95% Critical H Value (KM-Log) | 2.881 |
| KM Standard Error of Mean (logged) | 0.245 | 95% H-UCL (KM -Log) | 0.00319 |
| KM SD (logged) | 1.463 | 95% Critical H Value (KM-Log) | 2.881 |
| KM Standard Error of Mean (logged) | 0.245 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00147 | Mean in Log Scale | -7.273 |
| SD in Original Scale | 0.00219 | SD in Log Scale | 1.354 |
| 95% t UCL (Assumes normality) | 0.00201 | 95% H-Stat UCL | 0.00298 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**

**Suggested UCL to Use**

a Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 0.0022

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Endrin ketone

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 21 |
| | | Number of Missing Observations | 57 |
| Number of Detects | 12 | Number of Non-Detects | 16 |
| Number of Distinct Detects | 11 | Number of Distinct Non-Detects | 10 |
| Minimum Detect | 5.2000E-4 | Minimum Non-Detect | 7.1000E-4 |
| Maximum Detect | 0.008 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 4.3387E-6 | Percent Non-Detects | 57.14% |
| Mean Detects | 0.00304 | SD Detects | 0.00208 |
| Median Detects | 0.00235 | CV Detects | 0.686 |
| Skewness Detects | 1.541 | Kurtosis Detects | 2.216 |
| Mean of Logged Detects | -6.002 | SD of Logged Detects | 0.694 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.838 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.238 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Approximate Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0016 | KM Standard Error of Mean | 3.5603E-4 |
| KM SD | 0.0018 | 95% KM (BCA) UCL | 0.00232 |
| 95% KM (t) UCL | 0.0022 | 95% KM (Percentile Bootstrap) UCL | 0.00225 |
| 95% KM (z) UCL | 0.00218 | 95% KM Bootstrap t UCL | 0.00256 |
| 90% KM Chebyshev UCL | 0.00267 | 95% KM Chebyshev UCL | 0.00315 |
| 97.5% KM Chebyshev UCL | 0.00382 | 99% KM Chebyshev UCL | 0.00514 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.411 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.74 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.157 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.248 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.601 | k star (bias corrected MLE) | 2.006 |
| Theta hat (MLE) | 0.00117 | Theta star (bias corrected MLE) | 0.00151 |
| nu hat (MLE) | 62.42 | nu star (bias corrected) | 48.15 |
| Mean (detects) | 0.00304 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 5.2000E-4 | Mean | 0.00702 |
| Maximum | 0.01 | Median | 0.01 |
| SD | 0.00375 | CV | 0.535 |
| k hat (MLE) | 2.201 | k star (bias corrected MLE) | 1.989 |
| Theta hat (MLE) | 0.00319 | Theta star (bias corrected MLE) | 0.00353 |
| nu hat (MLE) | 123.2 | nu star (bias corrected) | 111.4 |
| Adjusted Level of Significance (β) | 0.0404 | | |
| Approximate Chi Square Value (111.37, α) | 88.01 | Adjusted Chi Square Value (111.37, β) | 86.73 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00888 | 95% Gamma Adjusted UCL (use when n<50) | 0.00901 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0016 | SD (KM) | 0.0018 |
| Variance (KM) | 3.2535E-6 | SE of Mean (KM) | 3.5603E-4 |
| k hat (KM) | 0.785 | k star (KM) | 0.724 |
| nu hat (KM) | 43.95 | nu star (KM) | 40.57 |
| theta hat (KM) | 0.00204 | theta star (KM) | 0.00221 |
| 80% gamma percentile (KM) | 0.00262 | 90% gamma percentile (KM) | 0.00398 |
| 95% gamma percentile (KM) | 0.00537 | 99% gamma percentile (KM) | 0.00869 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (40.57, α) | 26.97 | Adjusted Chi Square Value (40.57, β) | 26.29 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0024 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.00247 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.157 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00162 | Mean in Log Scale | -6.873 |
| SD in Original Scale | 0.00183 | SD in Log Scale | 0.921 |
| 95% t UCL (assumes normality of ROS data) | 0.00221 | 95% Percentile Bootstrap UCL | 0.00221 |
| 95% BCA Bootstrap UCL | 0.00231 | 95% Bootstrap t UCL | 0.00254 |
| 95% H-UCL (Log ROS) | 0.0024 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -6.893 | KM Geo Mean | 0.00101 |
| KM SD (logged) | 0.886 | 95% Critical H Value (KM-Log) | 2.321 |
| KM Standard Error of Mean (logged) | 0.175 | 95% H-UCL (KM -Log) | 0.00223 |
| KM SD (logged) | 0.886 | 95% Critical H Value (KM-Log) | 2.321 |
| KM Standard Error of Mean (logged) | 0.175 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00159 | Mean in Log Scale | -6.908 |
| SD in Original Scale | 0.00184 | SD in Log Scale | 0.923 |
| 95% t UCL (Assumes normality) | 0.00219 | 95% H-Stat UCL | 0.00233 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Normal Distributed at 5% Significance Level**

**Suggested UCL to Use**

95% KM (t) UCL 0.0022

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|2-Methylnaphthalene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 14 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 71 |
| Number of Detects | 13 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 13 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.0092 | Minimum Non-Detect | 0.27 |
| Maximum Detect | 0.082 | Maximum Non-Detect | 0.27 |
| Variance Detects | 6.9182E-4 | Percent Non-Detects | 7.143% |
| Mean Detects | 0.0389 | SD Detects | 0.0263 |
| Median Detects | 0.03 | CV Detects | 0.677 |
| Skewness Detects | 0.507 | Kurtosis Detects | -1.498 |
| Mean of Logged Detects | -3.49 | SD of Logged Detects | 0.753 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.874 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.204 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0389 | KM Standard Error of Mean | 0.00729 |
| KM SD | 0.0253 | 95% KM (BCA) UCL | 0.0507 |
| 95% KM (t) UCL | 0.0518 | 95% KM (Percentile Bootstrap) UCL | 0.051 |
| 95% KM (z) UCL | 0.0509 | 95% KM Bootstrap t UCL | 0.0537 |
| 90% KM Chebyshev UCL | 0.0607 | 95% KM Chebyshev UCL | 0.0707 |
| 97.5% KM Chebyshev UCL | 0.0844 | 99% KM Chebyshev UCL | 0.111 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.479 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.742 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.173 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.239 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.214 | k star (bias corrected MLE) | 1.754 |
| Theta hat (MLE) | 0.0176 | Theta star (bias corrected MLE) | 0.0222 |
| nu hat (MLE) | 57.56 | nu star (bias corrected) | 45.61 |
| Mean (detects) | 0.0389 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0092 | Mean | 0.0385 |
| Maximum | 0.082 | Median | 0.0315 |
| SD | 0.0253 | CV | 0.657 |
| k hat (MLE) | 2.368 | k star (bias corrected MLE) | 1.908 |
| Theta hat (MLE) | 0.0163 | Theta star (bias corrected MLE) | 0.0202 |
| nu hat (MLE) | 66.31 | nu star (bias corrected) | 53.43 |
| Adjusted Level of Significance (β) | 0.0312 | | |
| Approximate Chi Square Value (53.43, α) | 37.64 | Adjusted Chi Square Value (53.43, β) | 35.89 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0547 | 95% Gamma Adjusted UCL (use when n<50) | 0.0574 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0389 | SD (KM) | 0.0253 |
| Variance (KM) | 6.3860E-4 | SE of Mean (KM) | 0.00729 |
| k hat (KM) | 2.365 | k star (KM) | 1.906 |
| nu hat (KM) | 66.22 | nu star (KM) | 53.36 |
| theta hat (KM) | 0.0164 | theta star (KM) | 0.0204 |
| 80% gamma percentile (KM) | 0.0585 | 90% gamma percentile (KM) | 0.0764 |
| 95% gamma percentile (KM) | 0.0936 | 99% gamma percentile (KM) | 0.132 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (53.36, α) | 37.58 | Adjusted Chi Square Value (53.36, β) | 35.83 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0552 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0579 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.926 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.161 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0383 | Mean in Log Scale | -3.49 |
| SD in Original Scale | 0.0254 | SD in Log Scale | 0.724 |
| 95% t UCL (assumes normality of ROS data) | 0.0503 | 95% Percentile Bootstrap UCL | 0.0495 |
| 95% BCA Bootstrap UCL | 0.0499 | 95% Bootstrap t UCL | 0.0539 |
| 95% H-UCL (Log ROS) | 0.0637 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.49 | KM Geo Mean | 0.0305 |
| KM SD (logged) | 0.724 | 95% Critical H Value (KM-Log) | 2.369 |
| KM Standard Error of Mean (logged) | 0.209 | 95% H-UCL (KM -Log) | 0.0637 |
| KM SD (logged) | 0.724 | 95% Critical H Value (KM-Log) | 2.369 |
| KM Standard Error of Mean (logged) | 0.209 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0457 | Mean in Log Scale | -3.384 |
| SD in Original Scale | 0.036 | SD in Log Scale | 0.826 |
| 95% t UCL (Assumes normality) | 0.0628 | 95% H-Stat UCL | 0.0849 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.0518

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|4-Methylphenol

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 14 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 71 |
| Number of Detects | 6 | Number of Non-Detects | 8 |
| Number of Distinct Detects | 5 | Number of Distinct Non-Detects | 6 |
| Minimum Detect | 0.027 | Minimum Non-Detect | 0.16 |
| Maximum Detect | 0.11 | Maximum Non-Detect | 1.3 |
| Variance Detects | 0.00105 | Percent Non-Detects | 57.14% |
| Mean Detects | 0.073 | SD Detects | 0.0324 |
| Median Detects | 0.068 | CV Detects | 0.444 |
| Skewness Detects | -0.021 | Kurtosis Detects | -0.95 |
| Mean of Logged Detects | -2.718 | SD of Logged Detects | 0.521 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.916 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.788 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.207 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.325 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.073 | KM Standard Error of Mean | 0.0132 |
| KM SD | 0.0296 | 95% KM (BCA) UCL | 0.0948 |
| 95% KM (t) UCL | 0.0964 | 95% KM (Percentile Bootstrap) UCL | 0.0934 |
| 95% KM (z) UCL | 0.0948 | 95% KM Bootstrap t UCL | 0.109 |
| 90% KM Chebyshev UCL | 0.113 | 95% KM Chebyshev UCL | 0.131 |
| 97.5% KM Chebyshev UCL | 0.156 | 99% KM Chebyshev UCL | 0.205 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.328 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.698 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.206 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.333 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.148 | k star (bias corrected MLE) | 2.685 |
| Theta hat (MLE) | 0.0142 | Theta star (bias corrected MLE) | 0.0272 |
| nu hat (MLE) | 61.77 | nu star (bias corrected) | 32.22 |
| Mean (detects) | 0.073 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.027 | Mean | 0.0717 |
| Maximum | 0.11 | Median | 0.07 |
| SD | 0.0227 | CV | 0.317 |
| k hat (MLE) | 9.494 | k star (bias corrected MLE) | 7.507 |
| Theta hat (MLE) | 0.00755 | Theta star (bias corrected MLE) | 0.00955 |
| nu hat (MLE) | 265.8 | nu star (bias corrected) | 210.2 |
| Adjusted Level of Significance (β) | 0.0312 | | |
| Approximate Chi Square Value (210.19, α) | 177.6 | Adjusted Chi Square Value (210.19, β) | 173.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0848 | 95% Gamma Adjusted UCL (use when n<50) | 0.0868 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.073 | SD (KM) | 0.0296 |
| Variance (KM) | 8.7433E-4 | SE of Mean (KM) | 0.0132 |
| k hat (KM) | 6.095 | k star (KM) | 4.836 |
| nu hat (KM) | 170.7 | nu star (KM) | 135.4 |
| theta hat (KM) | 0.012 | theta star (KM) | 0.0151 |
| 80% gamma percentile (KM) | 0.0985 | 90% gamma percentile (KM) | 0.117 |
| 95% gamma percentile (KM) | 0.135 | 99% gamma percentile (KM) | 0.171 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (135.42, α) | 109.5 | Adjusted Chi Square Value (135.42, β) | 106.4 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0903 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0929 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.899 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.788 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.196 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.325 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0699 | Mean in Log Scale | -2.718 |
| SD in Original Scale | 0.0234 | SD in Log Scale | 0.365 |
| 95% t UCL (assumes normality of ROS data) | 0.081 | 95% Percentile Bootstrap UCL | 0.0803 |
| 95% BCA Bootstrap UCL | 0.081 | 95% Bootstrap t UCL | 0.0822 |
| 95% H-UCL (Log ROS) | 0.086 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.718 | KM Geo Mean | 0.066 |
| KM SD (logged) | 0.476 | 95% Critical H Value (KM-Log) | 2.008 |
| KM Standard Error of Mean (logged) | 0.213 | 95% H-UCL (KM -Log) | 0.0964 |
| KM SD (logged) | 0.476 | 95% Critical H Value (KM-Log) | 2.008 |
| KM Standard Error of Mean (logged) | 0.213 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.157 | Mean in Log Scale | -2.138 |
| SD in Original Scale | 0.154 | SD in Log Scale | 0.757 |
| 95% t UCL (Assumes normality) | 0.23 | 95% H-Stat UCL | 0.261 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.0964

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Acenaphthene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 50 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 55 | Number of Non-Detects | 14 |
| Number of Distinct Detects | 40 | Number of Distinct Non-Detects | 12 |
| Minimum Detect | 0.0077 | Minimum Non-Detect | 0.0066 |
| Maximum Detect | 0.43 | Maximum Non-Detect | 0.27 |
| Variance Detects | 0.00374 | Percent Non-Detects | 20.29% |
| Mean Detects | 0.0524 | SD Detects | 0.0612 |
| Median Detects | 0.035 | CV Detects | 1.167 |
| Skewness Detects | 4.75 | Kurtosis Detects | 27.54 |
| Mean of Logged Detects | -3.255 | SD of Logged Detects | 0.726 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.543 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.244 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.119 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0485 | KM Standard Error of Mean | 0.00695 |
| KM SD | 0.056 | 95% KM (BCA) UCL | 0.0611 |
| 95% KM (t) UCL | 0.0601 | 95% KM (Percentile Bootstrap) UCL | 0.0605 |
| 95% KM (z) UCL | 0.0599 | 95% KM Bootstrap t UCL | 0.0701 |
| 90% KM Chebyshev UCL | 0.0694 | 95% KM Chebyshev UCL | 0.0788 |
| 97.5% KM Chebyshev UCL | 0.0919 | 99% KM Chebyshev UCL | 0.118 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.6 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.765 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.166 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.122 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.779 | k star (bias corrected MLE) | 1.694 |
| Theta hat (MLE) | 0.0295 | Theta star (bias corrected MLE) | 0.0309 |
| nu hat (MLE) | 195.6 | nu star (bias corrected) | 186.3 |
| Mean (detects) | 0.0524 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0077 | Mean | 0.0473 |
| Maximum | 0.43 | Median | 0.0346 |
| SD | 0.0558 | CV | 1.18 |
| k hat (MLE) | 1.78 | k star (bias corrected MLE) | 1.712 |
| Theta hat (MLE) | 0.0266 | Theta star (bias corrected MLE) | 0.0276 |
| nu hat (MLE) | 245.7 | nu star (bias corrected) | 236.3 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (236.32, α) | 201.7 | Adjusted Chi Square Value (236.32, β) | 201.1 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0555 | 95% Gamma Adjusted UCL (use when n<50) | 0.0557 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0485 | SD (KM) | 0.056 |
| Variance (KM) | 0.00314 | SE of Mean (KM) | 0.00695 |
| k hat (KM) | 0.749 | k star (KM) | 0.726 |
| nu hat (KM) | 103.3 | nu star (KM) | 100.2 |
| theta hat (KM) | 0.0648 | theta star (KM) | 0.0668 |
| 80% gamma percentile (KM) | 0.0796 | 90% gamma percentile (KM) | 0.121 |
| 95% gamma percentile (KM) | 0.163 | 99% gamma percentile (KM) | 0.263 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (100.17, α) | 78.08 | Adjusted Chi Square Value (100.17, β) | 77.66 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0622 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0625 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.971 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.384 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.12 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.119 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data appear Approximate Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0476 | Mean in Log Scale | -3.343 |
| SD in Original Scale | 0.0556 | SD in Log Scale | 0.72 |
| 95% t UCL (assumes normality of ROS data) | 0.0587 | 95% Percentile Bootstrap UCL | 0.0602 |
| 95% BCA Bootstrap UCL | 0.0655 | 95% Bootstrap t UCL | 0.0686 |
| 95% H-UCL (Log ROS) | 0.0547 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.35 | KM Geo Mean | 0.0351 |
| KM SD (logged) | 0.766 | 95% Critical H Value (KM-Log) | 2.073 |
| KM Standard Error of Mean (logged) | 0.0998 | 95% H-UCL (KM -Log) | 0.057 |
| KM SD (logged) | 0.766 | 95% Critical H Value (KM-Log) | 2.073 |
| KM Standard Error of Mean (logged) | 0.0998 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0563 | Mean in Log Scale | -3.23 |
| SD in Original Scale | 0.0595 | SD in Log Scale | 0.862 |
| 95% t UCL (Assumes normality) | 0.0683 | 95% H-Stat UCL | 0.0719 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

KM H-UCL 0.057

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Acenaphthylene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 51 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 57 | Number of Non-Detects | 12 |
| Number of Distinct Detects | 41 | Number of Distinct Non-Detects | 12 |
| Minimum Detect | 0.016 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 0.17 | Maximum Non-Detect | 0.27 |
| Variance Detects | 8.0847E-4 | Percent Non-Detects | 17.39% |
| Mean Detects | 0.0651 | SD Detects | 0.0284 |
| Median Detects | 0.064 | CV Detects | 0.437 |
| Skewness Detects | 0.897 | Kurtosis Detects | 2.091 |
| Mean of Logged Detects | -2.833 | SD of Logged Detects | 0.477 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.956 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0.0769 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.091 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.117 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0616 | KM Standard Error of Mean | 0.00374 |
| KM SD | 0.0293 | 95% KM (BCA) UCL | 0.0677 |
| 95% KM (t) UCL | 0.0678 | 95% KM (Percentile Bootstrap) UCL | 0.0679 |
| 95% KM (z) UCL | 0.0678 | 95% KM Bootstrap t UCL | 0.0684 |
| 90% KM Chebyshev UCL | 0.0728 | 95% KM Chebyshev UCL | 0.0779 |
| 97.5% KM Chebyshev UCL | 0.085 | 99% KM Chebyshev UCL | 0.0989 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.353 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.753 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0846 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.118 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.101 | k star (bias corrected MLE) | 4.844 |
| Theta hat (MLE) | 0.0128 | Theta star (bias corrected MLE) | 0.0134 |
| nu hat (MLE) | 581.5 | nu star (bias corrected) | 552.2 |
| Mean (detects) | 0.0651 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0142 | Mean | 0.0617 |
| Maximum | 0.17 | Median | 0.0578 |
| SD | 0.0276 | CV | 0.448 |
| k hat (MLE) | 4.842 | k star (bias corrected MLE) | 4.641 |
| Theta hat (MLE) | 0.0127 | Theta star (bias corrected MLE) | 0.0133 |
| nu hat (MLE) | 668.1 | nu star (bias corrected) | 640.4 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (640.42, α) | 582.7 | Adjusted Chi Square Value (640.42, β) | 581.5 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0678 | 95% Gamma Adjusted UCL (use when n<50) | 0.0679 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0616 | SD (KM) | 0.0293 |
| Variance (KM) | 8.5901E-4 | SE of Mean (KM) | 0.00374 |
| k hat (KM) | 4.418 | k star (KM) | 4.235 |
| nu hat (KM) | 609.6 | nu star (KM) | 584.5 |
| theta hat (KM) | 0.0139 | theta star (KM) | 0.0145 |
| 80% gamma percentile (KM) | 0.0844 | 90% gamma percentile (KM) | 0.102 |
| 95% gamma percentile (KM) | 0.118 | 99% gamma percentile (KM) | 0.152 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (584.47, α) | 529.4 | Adjusted Chi Square Value (584.47, β) | 528.3 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.068 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0682 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.959 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.111 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.11 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.117 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0614 | Mean in Log Scale | -2.894 |
| SD in Original Scale | 0.0276 | SD in Log Scale | 0.48 |
| 95% t UCL (assumes normality of ROS data) | 0.067 | 95% Percentile Bootstrap UCL | 0.067 |
| 95% BCA Bootstrap UCL | 0.0668 | 95% Bootstrap t UCL | 0.0672 |
| 95% H-UCL (Log ROS) | 0.0692 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.928 | KM Geo Mean | 0.0535 |
| KM SD (logged) | 0.592 | 95% Critical H Value (KM-Log) | 1.934 |
| KM Standard Error of Mean (logged) | 0.0779 | 95% H-UCL (KM -Log) | 0.0732 |
| KM SD (logged) | 0.592 | 95% Critical H Value (KM-Log) | 1.934 |
| KM Standard Error of Mean (logged) | 0.0779 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0645 | Mean in Log Scale | -2.895 |
| SD in Original Scale | 0.032 | SD in Log Scale | 0.635 |
| 95% t UCL (Assumes normality) | 0.071 | 95% H-Stat UCL | 0.0787 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.0678

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Acetophenone

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 14 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 71 |
| Number of Detects | 6 | Number of Non-Detects | 8 |
| Number of Distinct Detects | 5 | Number of Distinct Non-Detects | 7 |
| Minimum Detect | 0.015 | Minimum Non-Detect | 0.12 |
| Maximum Detect | 0.044 | Maximum Non-Detect | 1.3 |
| Variance Detects | 1.0480E-4 | Percent Non-Detects | 57.14% |
| Mean Detects | 0.031 | SD Detects | 0.0102 |
| Median Detects | 0.03 | CV Detects | 0.33 |
| Skewness Detects | -0.346 | Kurtosis Detects | 0.182 |
| Mean of Logged Detects | -3.528 | SD of Logged Detects | 0.379 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.949 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.788 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.206 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.325 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.031 | KM Standard Error of Mean | 0.00418 |
| KM SD | 0.00935 | 95% KM (BCA) UCL | 0.0381 |
| 95% KM (t) UCL | 0.0384 | 95% KM (Percentile Bootstrap) UCL | 0.0376 |
| 95% KM (z) UCL | 0.0379 | 95% KM Bootstrap t UCL | 0.0401 |
| 90% KM Chebyshev UCL | 0.0435 | 95% KM Chebyshev UCL | 0.0492 |
| 97.5% KM Chebyshev UCL | 0.0571 | 99% KM Chebyshev UCL | 0.0726 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.349 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.698 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.214 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.333 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 9.407 | k star (bias corrected MLE) | 4.814 |
| Theta hat (MLE) | 0.0033 | Theta star (bias corrected MLE) | 0.00644 |
| nu hat (MLE) | 112.9 | nu star (bias corrected) | 57.77 |
| Mean (detects) | 0.031 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.015 | Mean | 0.0306 |
| Maximum | 0.044 | Median | 0.0303 |
| SD | 0.00671 | CV | 0.219 |
| k hat (MLE) | 19.73 | k star (bias corrected MLE) | 15.55 |
| Theta hat (MLE) | 0.00155 | Theta star (bias corrected MLE) | 0.00197 |
| nu hat (MLE) | 552.5 | nu star (bias corrected) | 435.4 |
| Adjusted Level of Significance (β) | 0.0312 | | |
| Approximate Chi Square Value (435.42, α) | 388 | Adjusted Chi Square Value (435.42, β) | 382.1 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0344 | 95% Gamma Adjusted UCL (use when n<50) | 0.0349 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.031 | SD (KM) | 0.00935 |
| Variance (KM) | 8.7333E-5 | SE of Mean (KM) | 0.00418 |
| k hat (KM) | 11 | k star (KM) | 8.693 |
| nu hat (KM) | 308.1 | nu star (KM) | 243.4 |
| theta hat (KM) | 0.00282 | theta star (KM) | 0.00357 |
| 80% gamma percentile (KM) | 0.0393 | 90% gamma percentile (KM) | 0.045 |
| 95% gamma percentile (KM) | 0.0501 | 99% gamma percentile (KM) | 0.0605 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (243.42, α) | 208.3 | Adjusted Chi Square Value (243.42, β) | 204 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0362 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.037 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.896 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.788 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.246 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.325 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0301 | Mean in Log Scale | -3.528 |
| SD in Original Scale | 0.0068 | SD in Log Scale | 0.248 |
| 95% t UCL (assumes normality of ROS data) | 0.0334 | 95% Percentile Bootstrap UCL | 0.033 |
| 95% BCA Bootstrap UCL | 0.0329 | 95% Bootstrap t UCL | 0.0337 |
| 95% H-UCL (Log ROS) | 0.0344 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.528 | KM Geo Mean | 0.0294 |
| KM SD (logged) | 0.346 | 95% Critical H Value (KM-Log) | 1.934 |
| KM Standard Error of Mean (logged) | 0.155 | 95% H-UCL (KM -Log) | 0.0375 |
| KM SD (logged) | 0.346 | 95% Critical H Value (KM-Log) | 1.934 |
| KM Standard Error of Mean (logged) | 0.155 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.137 | Mean in Log Scale | -2.511 |
| SD in Original Scale | 0.165 | SD in Log Scale | 1.064 |
| 95% t UCL (Assumes normality) | 0.215 | 95% H-Stat UCL | 0.336 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.0384

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Anthracene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 66 | Number of Non-Detects | 3 |
| Number of Distinct Detects | 37 | Number of Distinct Non-Detects | 3 |
| Minimum Detect | 0.016 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 0.86 | Maximum Non-Detect | 0.23 |
| Variance Detects | 0.0119 | Percent Non-Detects | 4.348% |
| Mean Detects | 0.134 | SD Detects | 0.109 |
| Median Detects | 0.11 | CV Detects | 0.816 |
| Skewness Detects | 4.803 | Kurtosis Detects | 30.53 |
| Mean of Logged Detects | -2.193 | SD of Logged Detects | 0.586 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.605 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.225 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.109 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.13 | KM Standard Error of Mean | 0.0131 |
| KM SD | 0.108 | 95% KM (BCA) UCL | 0.156 |
| 95% KM (t) UCL | 0.152 | 95% KM (Percentile Bootstrap) UCL | 0.154 |
| 95% KM (z) UCL | 0.151 | 95% KM Bootstrap t UCL | 0.168 |
| 90% KM Chebyshev UCL | 0.169 | 95% KM Chebyshev UCL | 0.187 |
| 97.5% KM Chebyshev UCL | 0.212 | 99% KM Chebyshev UCL | 0.26 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.566 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.758 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.152 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.111 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.93 | k star (bias corrected MLE) | 2.807 |
| Theta hat (MLE) | 0.0456 | Theta star (bias corrected MLE) | 0.0476 |
| nu hat (MLE) | 386.8 | nu star (bias corrected) | 370.6 |
| Mean (detects) | 0.134 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.13 |
| Maximum | 0.86 | Median | 0.11 |
| SD | 0.109 | CV | 0.839 |
| k hat (MLE) | 2.42 | k star (bias corrected MLE) | 2.324 |
| Theta hat (MLE) | 0.0536 | Theta star (bias corrected MLE) | 0.0558 |
| nu hat (MLE) | 334 | nu star (bias corrected) | 320.8 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (320.77, α) | 280.3 | Adjusted Chi Square Value (320.77, β) | 279.5 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.148 | 95% Gamma Adjusted UCL (use when n<50) | 0.149 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.13 | SD (KM) | 0.108 |
| Variance (KM) | 0.0117 | SE of Mean (KM) | 0.0131 |
| k hat (KM) | 1.441 | k star (KM) | 1.388 |
| nu hat (KM) | 198.9 | nu star (KM) | 191.6 |
| theta hat (KM) | 0.09 | theta star (KM) | 0.0934 |
| 80% gamma percentile (KM) | 0.202 | 90% gamma percentile (KM) | 0.275 |
| 95% gamma percentile (KM) | 0.347 | 99% gamma percentile (KM) | 0.509 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (191.58, α) | 160.6 | Adjusted Chi Square Value (191.58, β) | 160 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.155 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.155 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.95 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.0211 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.109 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.109 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.13 | Mean in Log Scale | -2.233 |
| SD in Original Scale | 0.108 | SD in Log Scale | 0.616 |
| 95% t UCL (assumes normality of ROS data) | 0.152 | 95% Percentile Bootstrap UCL | 0.154 |
| 95% BCA Bootstrap UCL | 0.165 | 95% Bootstrap t UCL | 0.165 |
| 95% H-UCL (Log ROS) | 0.15 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.268 | KM Geo Mean | 0.104 |
| KM SD (logged) | 0.714 | 95% Critical H Value (KM-Log) | 2.029 |
| KM Standard Error of Mean (logged) | 0.0875 | 95% H-UCL (KM -Log) | 0.159 |
| KM SD (logged) | 0.714 | 95% Critical H Value (KM-Log) | 2.029 |
| KM Standard Error of Mean (logged) | 0.0875 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 0.13 | Mean in Log Scale | -2.268 |
| SD in Original Scale | 0.109 | SD in Log Scale | 0.738 |
| 95% t UCL (Assumes normality) | 0.152 | 95% H-Stat UCL | 0.163 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

### Suggested UCL to Use

95% KM (Chebyshev) UCL 0.187

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Benzaldehyde

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 72 |
| Number of Detects | 11 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 10 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.024 | Minimum Non-Detect | 0.3 |
| Maximum Detect | 0.32 | Maximum Non-Detect | 1.3 |
| Variance Detects | 0.00938 | Percent Non-Detects | 15.38% |
| Mean Detects | 0.145 | SD Detects | 0.0968 |
| Median Detects | 0.14 | CV Detects | 0.668 |
| Skewness Detects | 0.543 | Kurtosis Detects | -0.917 |
| Mean of Logged Detects | -2.181 | SD of Logged Detects | 0.796 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.924 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.18 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.144 | KM Standard Error of Mean | 0.0285 |
| KM SD | 0.0913 | 95% KM (BCA) UCL | 0.191 |
| 95% KM (t) UCL | 0.194 | 95% KM (Percentile Bootstrap) UCL | 0.189 |
| 95% KM (z) UCL | 0.19 | 95% KM Bootstrap t UCL | 0.2 |
| 90% KM Chebyshev UCL | 0.229 | 95% KM Chebyshev UCL | 0.268 |
| 97.5% KM Chebyshev UCL | 0.322 | 99% KM Chebyshev UCL | 0.428 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.288 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.738 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.156 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.258 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.156 | k star (bias corrected MLE) | 1.629 |
| Theta hat (MLE) | 0.0673 | Theta star (bias corrected MLE) | 0.089 |
| nu hat (MLE) | 47.43 | nu star (bias corrected) | 35.83 |
| Mean (detects) | 0.145 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.024 | Mean | 0.141 |
| Maximum | 0.32 | Median | 0.125 |
| SD | 0.0889 | CV | 0.63 |
| k hat (MLE) | 2.497 | k star (bias corrected MLE) | 1.972 |
| Theta hat (MLE) | 0.0565 | Theta star (bias corrected MLE) | 0.0716 |
| nu hat (MLE) | 64.93 | nu star (bias corrected) | 51.28 |
| Adjusted Level of Significance (β) | 0.0301 | | |
| Approximate Chi Square Value (51.28, α) | 35.83 | Adjusted Chi Square Value (51.28, β) | 34 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.202 | 95% Gamma Adjusted UCL (use when n<50) | 0.213 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.144 | SD (KM) | 0.0913 |
| Variance (KM) | 0.00834 | SE of Mean (KM) | 0.0285 |
| k hat (KM) | 2.471 | k star (KM) | 1.952 |
| nu hat (KM) | 64.24 | nu star (KM) | 50.75 |
| theta hat (KM) | 0.0581 | theta star (KM) | 0.0735 |
| 80% gamma percentile (KM) | 0.216 | 90% gamma percentile (KM) | 0.281 |
| 95% gamma percentile (KM) | 0.343 | 99% gamma percentile (KM) | 0.482 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (50.75, α) | 35.39 | Adjusted Chi Square Value (50.75, β) | 33.57 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.206 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.217 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.943 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.152 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.139 | Mean in Log Scale | -2.191 |
| SD in Original Scale | 0.0897 | SD in Log Scale | 0.728 |
| 95% t UCL (assumes normality of ROS data) | 0.183 | 95% Percentile Bootstrap UCL | 0.177 |
| 95% BCA Bootstrap UCL | 0.183 | 95% Bootstrap t UCL | 0.194 |
| 95% H-UCL (Log ROS) | 0.242 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.189 | KM Geo Mean | 0.112 |
| KM SD (logged) | 0.756 | 95% Critical H Value (KM-Log) | 2.454 |
| KM Standard Error of Mean (logged) | 0.238 | 95% H-UCL (KM -Log) | 0.255 |
| KM SD (logged) | 0.756 | 95% Critical H Value (KM-Log) | 2.454 |
| KM Standard Error of Mean (logged) | 0.238 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.184 | Mean in Log Scale | -2.024 |
| SD in Original Scale | 0.166 | SD in Log Scale | 0.874 |
| 95% t UCL (Assumes normality) | 0.266 | 95% H-Stat UCL | 0.376 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.194

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Benzo(a)anthracene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 44 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 43 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.021 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 2.3 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 0.105 | Percent Non-Detects | 1.449% |
| Mean Detects | 0.534 | SD Detects | 0.324 |
| Median Detects | 0.475 | CV Detects | 0.608 |
| Skewness Detects | 2.735 | Kurtosis Detects | 12.51 |
| Mean of Logged Detects | -0.793 | SD of Logged Detects | 0.639 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.796 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 1.027E-12 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.177 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.526 | KM Standard Error of Mean | 0.0395 |
| KM SD | 0.326 | 95% KM (BCA) UCL | 0.598 |
| 95% KM (t) UCL | 0.592 | 95% KM (Percentile Bootstrap) UCL | 0.593 |
| 95% KM (z) UCL | 0.591 | 95% KM Bootstrap t UCL | 0.612 |
| 90% KM Chebyshev UCL | 0.644 | 95% KM Chebyshev UCL | 0.698 |
| 97.5% KM Chebyshev UCL | 0.772 | 99% KM Chebyshev UCL | 0.919 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.688 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.757 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.158 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.199 | k star (bias corrected MLE) | 3.067 |
| Theta hat (MLE) | 0.167 | Theta star (bias corrected MLE) | 0.174 |
| nu hat (MLE) | 435 | nu star (bias corrected) | 417.2 |
| Mean (detects) | 0.534 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.021 | Mean | 0.526 |
| Maximum | 2.3 | Median | 0.47 |
| SD | 0.327 | CV | 0.622 |
| k hat (MLE) | 2.833 | k star (bias corrected MLE) | 2.72 |
| Theta hat (MLE) | 0.186 | Theta star (bias corrected MLE) | 0.194 |
| nu hat (MLE) | 391 | nu star (bias corrected) | 375.3 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (375.32, α) | 331.4 | Adjusted Chi Square Value (375.32, β) | 330.5 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.596 | 95% Gamma Adjusted UCL (use when n<50) | 0.598 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.526 | SD (KM) | 0.326 |
| Variance (KM) | 0.106 | SE of Mean (KM) | 0.0395 |
| k hat (KM) | 2.61 | k star (KM) | 2.506 |
| nu hat (KM) | 360.1 | nu star (KM) | 345.8 |
| theta hat (KM) | 0.202 | theta star (KM) | 0.21 |
| 80% gamma percentile (KM) | 0.766 | 90% gamma percentile (KM) | 0.971 |
| 95% gamma percentile (KM) | 1.164 | 99% gamma percentile (KM) | 1.585 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (345.82, α) | 303.7 | Adjusted Chi Square Value (345.82, β) | 302.9 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.599 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.6 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.881 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 3.9294E-7 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.198 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.527 | Mean in Log Scale | -0.815 |
| SD in Original Scale | 0.326 | SD in Log Scale | 0.661 |
| 95% t UCL (assumes normality of ROS data) | 0.593 | 95% Percentile Bootstrap UCL | 0.59 |
| 95% BCA Bootstrap UCL | 0.612 | 95% Bootstrap t UCL | 0.614 |
| 95% H-UCL (Log ROS) | 0.646 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.854 | KM Geo Mean | 0.426 |
| KM SD (logged) | 0.806 | 95% Critical H Value (KM-Log) | 2.108 |
| KM Standard Error of Mean (logged) | 0.0978 | 95% H-UCL (KM -Log) | 0.724 |
| KM SD (logged) | 0.806 | 95% Critical H Value (KM-Log) | 2.108 |
| KM Standard Error of Mean (logged) | 0.0978 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.526 | Mean in Log Scale | -0.864 |
| SD in Original Scale | 0.328 | SD in Log Scale | 0.867 |
| 95% t UCL (Assumes normality) | 0.592 | 95% H-Stat UCL | 0.771 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 0.698

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Benzo(a)pyrene

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 45 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 44 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.028 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 2 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 0.0965 | Percent Non-Detects | 1.449% |
| Mean Detects | 0.599 | SD Detects | 0.311 |
| Median Detects | 0.545 | CV Detects | 0.519 |
| Skewness Detects | 1.629 | Kurtosis Detects | 5.495 |
| Mean of Logged Detects | -0.66 | SD of Logged Detects | 0.62 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.901 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 9.1165E-6 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.131 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.59 | KM Standard Error of Mean | 0.0381 |
| KM SD | 0.314 | 95% KM (BCA) UCL | 0.656 |
| 95% KM (t) UCL | 0.654 | 95% KM (Percentile Bootstrap) UCL | 0.653 |
| 95% KM (z) UCL | 0.653 | 95% KM Bootstrap t UCL | 0.664 |
| 90% KM Chebyshev UCL | 0.705 | 95% KM Chebyshev UCL | 0.756 |
| 97.5% KM Chebyshev UCL | 0.828 | 99% KM Chebyshev UCL | 0.969 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 1.198 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.756 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.151 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.548 | k star (bias corrected MLE) | 3.402 |
| Theta hat (MLE) | 0.169 | Theta star (bias corrected MLE) | 0.176 |
| nu hat (MLE) | 482.6 | nu star (bias corrected) | 462.6 |
| Mean (detects) | 0.599 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.028 | Mean | 0.591 |
| Maximum | 2 | Median | 0.54 |
| SD | 0.314 | CV | 0.532 |
| k hat (MLE) | 3.269 | k star (bias corrected MLE) | 3.137 |
| Theta hat (MLE) | 0.181 | Theta star (bias corrected MLE) | 0.189 |
| nu hat (MLE) | 451.1 | nu star (bias corrected) | 432.9 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (432.86, α) | 385.6 | Adjusted Chi Square Value (432.86, β) | 384.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.664 | 95% Gamma Adjusted UCL (use when n<50) | 0.665 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.59 | SD (KM) | 0.314 |
| Variance (KM) | 0.0987 | SE of Mean (KM) | 0.0381 |
| k hat (KM) | 3.53 | k star (KM) | 3.386 |
| nu hat (KM) | 487.1 | nu star (KM) | 467.2 |
| theta hat (KM) | 0.167 | theta star (KM) | 0.174 |
| 80% gamma percentile (KM) | 0.83 | 90% gamma percentile (KM) | 1.02 |
| 95% gamma percentile (KM) | 1.197 | 99% gamma percentile (KM) | 1.578 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (467.24, α) | 418.1 | Adjusted Chi Square Value (467.24, β) | 417.1 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.66 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.661 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.882 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 4.8092E-7 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.193 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.592 | Mean in Log Scale | -0.682 |
| SD in Original Scale | 0.314 | SD in Log Scale | 0.641 |
| 95% t UCL (assumes normality of ROS data) | 0.655 | 95% Percentile Bootstrap UCL | 0.657 |
| 95% BCA Bootstrap UCL | 0.664 | 95% Bootstrap t UCL | 0.662 |
| 95% H-UCL (Log ROS) | 0.724 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.723 | KM Geo Mean | 0.485 |
| KM SD (logged) | 0.802 | 95% Critical H Value (KM-Log) | 2.104 |
| KM Standard Error of Mean (logged) | 0.0972 | 95% H-UCL (KM -Log) | 0.821 |
| KM SD (logged) | 0.802 | 95% Critical H Value (KM-Log) | 2.104 |
| KM Standard Error of Mean (logged) | 0.0972 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.59 | Mean in Log Scale | -0.733 |
| SD in Original Scale | 0.317 | SD in Log Scale | 0.864 |
| 95% t UCL (Assumes normality) | 0.654 | 95% H-Stat UCL | 0.875 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 0.756

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_SVOCs|Benzo(g,h,i)perylene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 48 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 47 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.029 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 1.7 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 0.11 | Percent Non-Detects | 1.449% |
| Mean Detects | 0.649 | SD Detects | 0.332 |
| Median Detects | 0.63 | CV Detects | 0.512 |
| Skewness Detects | 0.937 | Kurtosis Detects | 1.347 |
| Mean of Logged Detects | -0.59 | SD of Logged Detects | 0.648 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.939 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0.0036 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.134 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.64 | KM Standard Error of Mean | 0.0408 |
| KM SD | 0.336 | 95% KM (BCA) UCL | 0.709 |
| 95% KM (t) UCL | 0.708 | 95% KM (Percentile Bootstrap) UCL | 0.708 |
| 95% KM (z) UCL | 0.707 | 95% KM Bootstrap t UCL | 0.71 |
| 90% KM Chebyshev UCL | 0.762 | 95% KM Chebyshev UCL | 0.818 |
| 97.5% KM Chebyshev UCL | 0.895 | 99% KM Chebyshev UCL | 1.046 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.804 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.757 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.106 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.316 | k star (bias corrected MLE) | 3.179 |
| Theta hat (MLE) | 0.196 | Theta star (bias corrected MLE) | 0.204 |
| nu hat (MLE) | 451 | nu star (bias corrected) | 432.4 |
| Mean (detects) | 0.649 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.029 | Mean | 0.641 |
| Maximum | 1.7 | Median | 0.63 |
| SD | 0.336 | CV | 0.525 |
| k hat (MLE) | 3.086 | k star (bias corrected MLE) | 2.961 |
| Theta hat (MLE) | 0.208 | Theta star (bias corrected MLE) | 0.217 |
| nu hat (MLE) | 425.8 | nu star (bias corrected) | 408.6 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (408.62, α) | 362.8 | Adjusted Chi Square Value (408.62, β) | 361.9 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.723 | 95% Gamma Adjusted UCL (use when n<50) | 0.724 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.64 | SD (KM) | 0.336 |
| Variance (KM) | 0.113 | SE of Mean (KM) | 0.0408 |
| k hat (KM) | 3.62 | k star (KM) | 3.473 |
| nu hat (KM) | 499.6 | nu star (KM) | 479.2 |
| theta hat (KM) | 0.177 | theta star (KM) | 0.184 |
| 80% gamma percentile (KM) | 0.897 | 90% gamma percentile (KM) | 1.101 |
| 95% gamma percentile (KM) | 1.289 | 99% gamma percentile (KM) | 1.694 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (479.24, α) | 429.5 | Adjusted Chi Square Value (479.24, β) | 428.5 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.714 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.716 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.891 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 2.0166E-6 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.149 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.642 | Mean in Log Scale | -0.613 |
| SD in Original Scale | 0.336 | SD in Log Scale | 0.671 |
| 95% t UCL (assumes normality of ROS data) | 0.709 | 95% Percentile Bootstrap UCL | 0.712 |
| 95% BCA Bootstrap UCL | 0.711 | 95% Bootstrap t UCL | 0.713 |
| 95% H-UCL (Log ROS) | 0.798 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.654 | KM Geo Mean | 0.52 |
| KM SD (logged) | 0.828 | 95% Critical H Value (KM-Log) | 2.128 |
| KM Standard Error of Mean (logged) | 0.1 | 95% H-UCL (KM -Log) | 0.907 |
| KM SD (logged) | 0.828 | 95% Critical H Value (KM-Log) | 2.128 |
| KM Standard Error of Mean (logged) | 0.1 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.64 | Mean in Log Scale | -0.664 |
| SD in Original Scale | 0.339 | SD in Log Scale | 0.89 |
| 95% t UCL (Assumes normality) | 0.708 | 95% H-Stat UCL | 0.968 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Approximate Gamma UCL | 0.714 | 95% GROS Approximate Gamma UCL | 0.723 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Benzo(k)fluoranthene

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 44 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 67 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 42 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.066 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 0.96 | Maximum Non-Detect | 0.042 |
| Variance Detects | 0.0245 | Percent Non-Detects | 2.899% |
| Mean Detects | 0.332 | SD Detects | 0.156 |
| Median Detects | 0.31 | CV Detects | 0.472 |
| Skewness Detects | 1.22 | Kurtosis Detects | 3.219 |
| Mean of Logged Detects | -1.218 | SD of Logged Detects | 0.508 |

| Normal GOF Test on Detects Only | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | Normal GOF Test on Detected Observations Only |
| 5% Shapiro Wilk P Value | 0.0015 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.12 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.108 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.322 | KM Standard Error of Mean | 0.0197 |
| KM SD | 0.162 | 95% KM (BCA) UCL | 0.359 |
| 95% KM (t) UCL | 0.355 | 95% KM (Percentile Bootstrap) UCL | 0.357 |
| 95% KM (z) UCL | 0.355 | 95% KM Bootstrap t UCL | 0.359 |
| 90% KM Chebyshev UCL | 0.381 | 95% KM Chebyshev UCL | 0.408 |
| 97.5% KM Chebyshev UCL | 0.445 | 99% KM Chebyshev UCL | 0.518 |

| Gamma GOF Tests on Detected Observations Only | | |
|---|---|---|
| A-D Test Statistic | 0.539 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.754 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0812 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.109 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 4.522 | k star (bias corrected MLE) | 4.33 |
| Theta hat (MLE) | 0.0733 | Theta star (bias corrected MLE) | 0.0766 |
| nu hat (MLE) | 606 | nu star (bias corrected) | 580.2 |
| Mean (detects) | 0.332 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0636 | Mean | 0.324 |
| Maximum | 0.96 | Median | 0.3 |
| SD | 0.161 | CV | 0.496 |
| k hat (MLE) | 3.85 | k star (bias corrected MLE) | 3.692 |
| Theta hat (MLE) | 0.0841 | Theta star (bias corrected MLE) | 0.0877 |
| nu hat (MLE) | 531.3 | nu star (bias corrected) | 509.5 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (509.52, α) | 458.2 | Adjusted Chi Square Value (509.52, β) | 457.1 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.36 | 95% Gamma Adjusted UCL (use when n<50) | 0.361 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.322 | SD (KM) | 0.162 |
| Variance (KM) | 0.0264 | SE of Mean (KM) | 0.0197 |
| k hat (KM) | 3.935 | k star (KM) | 3.774 |
| nu hat (KM) | 543.1 | nu star (KM) | 520.8 |
| theta hat (KM) | 0.0819 | theta star (KM) | 0.0854 |
| 80% gamma percentile (KM) | 0.447 | 90% gamma percentile (KM) | 0.545 |
| 95% gamma percentile (KM) | 0.634 | 99% gamma percentile (KM) | 0.827 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (520.81, α) | 468.9 | Adjusted Chi Square Value (520.81, β) | 467.8 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.358 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.359 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.954 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.0366 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.114 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.108 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.325 | Mean in Log Scale | -1.254 |
| SD in Original Scale | 0.16 | SD in Log Scale | 0.541 |
| 95% t UCL (assumes normality of ROS data) | 0.357 | 95% Percentile Bootstrap UCL | 0.357 |
| 95% BCA Bootstrap UCL | 0.359 | 95% Bootstrap t UCL | 0.359 |
| 95% H-UCL (Log ROS) | 0.374 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -1.328 | KM Geo Mean | 0.265 |
| KM SD (logged) | 0.807 | 95% Critical H Value (KM-Log) | 2.108 |
| KM Standard Error of Mean (logged) | 0.0978 | 95% H-UCL (KM -Log) | 0.451 |
| KM SD (logged) | 0.807 | 95% Critical H Value (KM-Log) | 2.108 |
| KM Standard Error of Mean (logged) | 0.0978 | | |

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.322 | Mean in Log Scale | -1.322 |
| SD in Original Scale | 0.163 | SD in Log Scale | 0.799 |
| 95% t UCL (Assumes normality) | 0.355 | 95% H-Stat UCL | 0.45 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 95% KM Approximate Gamma UCL | 0.358 | 95% GROS Approximate Gamma UCL | 0.36 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Benzoic acid

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 20 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 1 |
| Number of Detects | 10 | Number of Non-Detects | 10 |
| Number of Distinct Detects | 8 | Number of Distinct Non-Detects | 7 |
| Minimum Detect | 0.75 | Minimum Non-Detect | 0.077 |
| Maximum Detect | 1.4 | Maximum Non-Detect | 0.7 |
| Variance Detects | 0.038 | Percent Non-Detects | 50% |
| Mean Detects | 1.062 | SD Detects | 0.195 |
| Median Detects | 1.05 | CV Detects | 0.184 |
| Skewness Detects | 0.0593 | Kurtosis Detects | -0.377 |
| Mean of Logged Detects | 0.0445 | SD of Logged Detects | 0.188 |

| Normal GOF Test on Detects Only | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk Critical Value | 0.842 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.16 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.262 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.57 | KM Standard Error of Mean | 0.12 |
| KM SD | 0.51 | 95% KM (BCA) UCL | 0.797 |
| 95% KM (t) UCL | 0.777 | 95% KM (Percentile Bootstrap) UCL | 0.765 |
| 95% KM (z) UCL | 0.767 | 95% KM Bootstrap t UCL | 0.78 |
| 90% KM Chebyshev UCL | 0.93 | 95% KM Chebyshev UCL | 1.093 |
| 97.5% KM Chebyshev UCL | 1.32 | 99% KM Chebyshev UCL | 1.765 |

| Gamma GOF Tests on Detected Observations Only | | |
|---|---|---|
| A-D Test Statistic | 0.263 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.724 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.178 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 32.19 | k star (bias corrected MLE) | 22.6 |
| Theta hat (MLE) | 0.033 | Theta star (bias corrected MLE) | 0.047 |
| nu hat (MLE) | 643.9 | nu star (bias corrected) | 452.1 |
| Mean (detects) | 1.062 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.434 | Mean | 0.817 |
| Maximum | 1.4 | Median | 0.719 |
| SD | 0.289 | CV | 0.354 |
| k hat (MLE) | 8.688 | k star (bias corrected MLE) | 7.418 |
| Theta hat (MLE) | 0.094 | Theta star (bias corrected MLE) | 0.11 |
| nu hat (MLE) | 347.5 | nu star (bias corrected) | 296.7 |
| Adjusted Level of Significance (β) | 0.038 | | |
| Approximate Chi Square Value (296.71, α) | 257.8 | Adjusted Chi Square Value (296.71, β) | 255 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.94 | 95% Gamma Adjusted UCL (use when n<50) | 0.951 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.57 | SD (KM) | 0.51 |
| Variance (KM) | 0.26 | SE of Mean (KM) | 0.12 |
| k hat (KM) | 1.249 | k star (KM) | 1.095 |
| nu hat (KM) | 49.96 | nu star (KM) | 43.8 |
| theta hat (KM) | 0.456 | theta star (KM) | 0.52 |
| 80% gamma percentile (KM) | 0.909 | 90% gamma percentile (KM) | 1.282 |
| 95% gamma percentile (KM) | 1.652 | 99% gamma percentile (KM) | 2.506 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (43.80, α) | 29.62 | Adjusted Chi Square Value (43.80, β) | 28.7 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.842 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.869 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.963 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.168 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.846 | Mean in Log Scale | -0.21 |
| SD in Original Scale | 0.261 | SD in Log Scale | 0.297 |
| 95% t UCL (assumes normality of ROS data) | 0.947 | 95% Percentile Bootstrap UCL | 0.939 |
| 95% BCA Bootstrap UCL | 0.947 | 95% Bootstrap t UCL | 0.96 |
| 95% H-UCL (Log ROS) | 0.961 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -1.26 | KM Geo Mean | 0.284 |
| KM SD (logged) | 1.31 | 95% Critical H Value (KM-Log) | 3.111 |
| KM Standard Error of Mean (logged) | 0.309 | 95% H-UCL (KM -Log) | 1.706 |
| KM SD (logged) | 1.31 | 95% Critical H Value (KM-Log) | 3.111 |
| KM Standard Error of Mean (logged) | 0.309 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.583 | Mean in Log Scale | -1.208 |
| SD in Original Scale | 0.513 | SD in Log Scale | 1.354 |
| 95% t UCL (Assumes normality) | 0.782 | 95% H-Stat UCL | 2.009 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.777

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_SVOCs|bis-(2-Ethylhexyl)phthalate

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 34 | Number of Distinct Observations | 22 |
| | | Number of Missing Observations | 51 |
| Minimum | 0.21 | Mean | 1.509 |
| Maximum | 10 | Median | 1.2 |
| SD | 1.652 | Std. Error of Mean | 0.283 |
| Coefficient of Variation | 1.095 | Skewness | 4.412 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.519 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.933 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.318 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.15 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.989 | 95% Adjusted-CLT UCL (Chen-1995) | 2.205 |
| | | 95% Modified-t UCL (Johnson-1978) | 2.025 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.356 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.76 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.195 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.153 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.996 | k star (bias corrected MLE) | 1.839 |
| Theta hat (MLE) | 0.756 | Theta star (bias corrected MLE) | 0.821 |
| nu hat (MLE) | 135.7 | nu star (bias corrected) | 125.1 |
| MLE Mean (bias corrected) | 1.509 | MLE Sd (bias corrected) | 1.113 |
| | | Approximate Chi Square Value (0.05) | 100.2 |
| Adjusted Level of Significance | 0.0422 | Adjusted Chi Square Value | 99.13 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.883 | 95% Adjusted Gamma UCL (use when n<50) | 1.904 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.933 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.146 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.15 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.561 | Mean of logged Data | 0.141 |
| Maximum of Logged Data | 2.303 | SD of logged Data | 0.69 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.882 | 90% Chebyshev (MVUE) UCL | 2.006 |
| 95% Chebyshev (MVUE) UCL | 2.258 | 97.5% Chebyshev (MVUE) UCL | 2.609 |
| 99% Chebyshev (MVUE) UCL | 3.297 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.975 | 95% Jackknife UCL | 1.989 |
| 95% Standard Bootstrap UCL | 1.963 | 95% Bootstrap-t UCL | 2.73 |
| 95% Hall's Bootstrap UCL | 4.117 | 95% Percentile Bootstrap UCL | 2.045 |
| 95% BCA Bootstrap UCL | 2.313 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2.359 | 95% Chebyshev(Mean, Sd) UCL | 2.745 |
| 97.5% Chebyshev(Mean, Sd) UCL | 3.279 | 99% Chebyshev(Mean, Sd) UCL | 4.329 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% H-UCL | 1.882 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_SVOCs|Butylbenzylphthalate

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 34 | Number of Distinct Observations | 28 |
| | | Number of Missing Observations | 51 |
| Number of Detects | 17 | Number of Non-Detects | 17 |
| Number of Distinct Detects | 14 | Number of Distinct Non-Detects | 16 |
| Minimum Detect | 0.043 | Minimum Non-Detect | 0.025 |
| Maximum Detect | 2.5 | Maximum Non-Detect | 1.3 |
| Variance Detects | 0.341 | Percent Non-Detects | 50% |
| Mean Detects | 0.241 | SD Detects | 0.584 |
| Median Detects | 0.086 | CV Detects | 2.427 |
| Skewness Detects | 4.085 | Kurtosis Detects | 16.77 |
| Mean of Logged Detects | -2.194 | SD of Logged Detects | 0.89 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.32 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.892 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.455 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.207 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.149 | KM Standard Error of Mean | 0.0729 |
| KM SD | 0.412 | 95% KM (BCA) UCL | 0.304 |
| 95% KM (t) UCL | 0.273 | 95% KM (Percentile Bootstrap) UCL | 0.29 |
| 95% KM (z) UCL | 0.269 | 95% KM Bootstrap t UCL | 0.997 |
| 90% KM Chebyshev UCL | 0.368 | 95% KM Chebyshev UCL | 0.467 |
| 97.5% KM Chebyshev UCL | 0.604 | 99% KM Chebyshev UCL | 0.875 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 3.544 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.775 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.383 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.217 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.775 | k star (bias corrected MLE) | 0.677 |
| Theta hat (MLE) | 0.31 | Theta star (bias corrected MLE) | 0.355 |
| nu hat (MLE) | 26.34 | nu star (bias corrected) | 23.02 |
| Mean (detects) | 0.241 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.125 |
| Maximum | 2.5 | Median | 0.0265 |
| SD | 0.423 | CV | 3.377 |
| k hat (MLE) | 0.483 | k star (bias corrected MLE) | 0.46 |
| Theta hat (MLE) | 0.259 | Theta star (bias corrected MLE) | 0.272 |
| nu hat (MLE) | 32.84 | nu star (bias corrected) | 31.27 |
| Adjusted Level of Significance (β) | 0.0422 | | |
| Approximate Chi Square Value (31.27, α) | 19.5 | Adjusted Chi Square Value (31.27, β) | 19.04 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.201 | 95% Gamma Adjusted UCL (use when n<50) | 0.206 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.149 | SD (KM) | 0.412 |
| Variance (KM) | 0.169 | SE of Mean (KM) | 0.0729 |
| k hat (KM) | 0.131 | k star (KM) | 0.139 |
| nu hat (KM) | 8.926 | nu star (KM) | 9.472 |
| theta hat (KM) | 1.136 | theta star (KM) | 1.071 |
| 80% gamma percentile (KM) | 0.152 | 90% gamma percentile (KM) | 0.437 |
| 95% gamma percentile (KM) | 0.832 | 99% gamma percentile (KM) | 1.997 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (9.47, α) | 3.614 | Adjusted Chi Square Value (9.47, β) | 3.437 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.391 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.411 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.669 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.892 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.29 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.207 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.144 | Mean in Log Scale | -2.677 |
| SD in Original Scale | 0.418 | SD in Log Scale | 0.856 |
| 95% t UCL (assumes normality of ROS data) | 0.265 | 95% Percentile Bootstrap UCL | 0.283 |
| 95% BCA Bootstrap UCL | 0.362 | 95% Bootstrap t UCL | 1.168 |
| 95% H-UCL (Log ROS) | 0.139 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.605 | KM Geo Mean | 0.0739 |
| KM SD (logged) | 0.836 | 95% Critical H Value (KM-Log) | 2.259 |
| KM Standard Error of Mean (logged) | 0.17 | 95% H-UCL (KM -Log) | 0.146 |
| KM SD (logged) | 0.836 | 95% Critical H Value (KM-Log) | 2.259 |
| KM Standard Error of Mean (logged) | 0.17 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.177 | Mean in Log Scale | -2.453 |
| SD in Original Scale | 0.425 | SD in Log Scale | 0.971 |
| 95% t UCL (Assumes normality) | 0.3 | 95% H-Stat UCL | 0.207 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

### Suggested UCL to Use

95% KM (Chebyshev) UCL 0.467

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Carbazole

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 14 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 71 |
| Minimum | 0.023 | Mean | 0.0931 |
| Maximum | 0.25 | Median | 0.0855 |
| SD | 0.0581 | Std. Error of Mean | 0.0155 |
| Coefficient of Variation | 0.624 | Skewness | 1.619 |

| Normal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.844 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk Critical Value | 0.874 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.243 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.226 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

| Assuming Normal Distribution | | | |
|---|---|---|---|
| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 95% Student's-t UCL | 0.121 | 95% Adjusted-CLT UCL (Chen-1995) | 0.126 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.122 |

| Gamma GOF Test | | |
|---|---|---|
| A-D Test Statistic | 0.471 | Anderson-Darling Gamma GOF Test |
| 5% A-D Critical Value | 0.742 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.17 | Kolmogorov-Smirnov Gamma GOF Test |
| 5% K-S Critical Value | 0.23 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 3.017 | k star (bias corrected MLE) | 2.418 |
| Theta hat (MLE) | 0.0309 | Theta star (bias corrected MLE) | 0.0385 |
| nu hat (MLE) | 84.46 | nu star (bias corrected) | 67.7 |
| MLE Mean (bias corrected) | 0.0931 | MLE Sd (bias corrected) | 0.0599 |
| | | Approximate Chi Square Value (0.05) | 49.76 |
| Adjusted Level of Significance | 0.0312 | Adjusted Chi Square Value | 47.72 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.127 | 95% Adjusted Gamma UCL (use when n<50) | 0.132 |

| Lognormal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.921 | Shapiro Wilk Lognormal GOF Test |
| 5% Shapiro Wilk Critical Value | 0.874 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.177 | Lilliefors Lognormal GOF Test |
| 5% Lilliefors Critical Value | 0.226 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.772 | Mean of logged Data | -2.548 |
| Maximum of Logged Data | -1.386 | SD of logged Data | 0.639 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 0.143 | 90% Chebyshev (MVUE) UCL | 0.145 |
| 95% Chebyshev (MVUE) UCL | 0.168 | 97.5% Chebyshev (MVUE) UCL | 0.199 |
| 99% Chebyshev (MVUE) UCL | 0.261 | | |

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 0.119 | 95% Jackknife UCL | 0.121 |
| 95% Standard Bootstrap UCL | 0.118 | 95% Bootstrap-t UCL | 0.136 |
| 95% Hall's Bootstrap UCL | 0.284 | 95% Percentile Bootstrap UCL | 0.119 |
| 95% BCA Bootstrap UCL | 0.122 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.14 | 95% Chebyshev(Mean, Sd) UCL | 0.161 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.19 | 99% Chebyshev(Mean, Sd) UCL | 0.248 |

Suggested UCL to Use

95% Adjusted Gamma UCL 0.132

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Chrysene

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 47 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 46 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.031 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 2.4 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 0.138 | Percent Non-Detects | 1.449% |
| Mean Detects | 0.814 | SD Detects | 0.371 |
| Median Detects | 0.78 | CV Detects | 0.456 |
| Skewness Detects | 1.269 | Kurtosis Detects | 4.316 |
| Mean of Logged Detects | -0.333 | SD of Logged Detects | 0.595 |

| Normal GOF Test on Detects Only | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0.00134 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.146 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.802 | KM Standard Error of Mean | 0.0459 |
| KM SD | 0.378 | 95% KM (BCA) UCL | 0.882 |
| 95% KM (t) UCL | 0.878 | 95% KM (Percentile Bootstrap) UCL | 0.879 |
| 95% KM (z) UCL | 0.877 | 95% KM Bootstrap t UCL | 0.889 |
| 90% KM Chebyshev UCL | 0.94 | 95% KM Chebyshev UCL | 1.002 |
| 97.5% KM Chebyshev UCL | 1.088 | 99% KM Chebyshev UCL | 1.258 |

| Gamma GOF Tests on Detected Observations Only | | |
|---|---|---|
| A-D Test Statistic | 1.391 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.755 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.114 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.108 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 4.103 | k star (bias corrected MLE) | 3.932 |
| Theta hat (MLE) | 0.198 | Theta star (bias corrected MLE) | 0.207 |
| nu hat (MLE) | 558 | nu star (bias corrected) | 534.7 |
| Mean (detects) | 0.814 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.031 | Mean | 0.805 |
| Maximum | 2.4 | Median | 0.77 |
| SD | 0.376 | CV | 0.468 |
| k hat (MLE) | 3.849 | k star (bias corrected MLE) | 3.692 |
| Theta hat (MLE) | 0.209 | Theta star (bias corrected MLE) | 0.218 |
| nu hat (MLE) | 531.2 | nu star (bias corrected) | 509.4 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (509.45, α) | 458.1 | Adjusted Chi Square Value (509.45, β) | 457.1 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.895 | 95% Gamma Adjusted UCL (use when n<50) | 0.897 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.802 | SD (KM) | 0.378 |
| Variance (KM) | 0.143 | SE of Mean (KM) | 0.0459 |
| k hat (KM) | 4.498 | k star (KM) | 4.312 |
| nu hat (KM) | 620.8 | nu star (KM) | 595.1 |
| theta hat (KM) | 0.178 | theta star (KM) | 0.186 |
| 80% gamma percentile (KM) | 1.096 | 90% gamma percentile (KM) | 1.319 |
| 95% gamma percentile (KM) | 1.524 | 99% gamma percentile (KM) | 1.96 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (595.10, α) | 539.5 | Adjusted Chi Square Value (595.10, β) | 538.4 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.885 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.886 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.834 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 2.642E-10 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.155 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.804 | Mean in Log Scale | -0.353 |
| SD in Original Scale | 0.376 | SD in Log Scale | 0.614 |
| 95% t UCL (assumes normality of ROS data) | 0.88 | 95% Percentile Bootstrap UCL | 0.877 |
| 95% BCA Bootstrap UCL | 0.887 | 95% Bootstrap t UCL | 0.886 |
| 95% H-UCL (Log ROS) | 0.981 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.401 | KM Geo Mean | 0.67 |
| KM SD (logged) | 0.81 | 95% Critical H Value (KM-Log) | 2.111 |
| KM Standard Error of Mean (logged) | 0.0982 | 95% H-UCL (KM -Log) | 1.144 |
| KM SD (logged) | 0.81 | 95% Critical H Value (KM-Log) | 2.111 |
| KM Standard Error of Mean (logged) | 0.0982 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.802 | Mean in Log Scale | -0.411 |
| SD in Original Scale | 0.381 | SD in Log Scale | 0.876 |
| 95% t UCL (Assumes normality) | 0.878 | 95% H-Stat UCL | 1.225 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 1.002

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Di-n-octylphthalate

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 34 | Number of Distinct Observations | 28 |
| | | Number of Missing Observations | 51 |
| Number of Detects | 7 | Number of Non-Detects | 27 |
| Number of Distinct Detects | 7 | Number of Distinct Non-Detects | 21 |
| Minimum Detect | 0.042 | Minimum Non-Detect | 0.02 |
| Maximum Detect | 0.4 | Maximum Non-Detect | 1.3 |
| Variance Detects | 0.0172 | Percent Non-Detects | 79.41% |
| Mean Detects | 0.223 | SD Detects | 0.131 |
| Median Detects | 0.24 | CV Detects | 0.587 |
| Skewness Detects | -0.08 | Kurtosis Detects | -1.41 |
| Mean of Logged Detects | -1.719 | SD of Logged Detects | 0.801 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.14 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0715 | KM Standard Error of Mean | 0.0209 |
| KM SD | 0.104 | 95% KM (BCA) UCL | 0.119 |
| 95% KM (t) UCL | 0.107 | 95% KM (Percentile Bootstrap) UCL | 0.108 |
| 95% KM (z) UCL | 0.106 | 95% KM Bootstrap t UCL | 0.102 |
| 90% KM Chebyshev UCL | 0.134 | 95% KM Chebyshev UCL | 0.163 |
| 97.5% KM Chebyshev UCL | 0.202 | 99% KM Chebyshev UCL | 0.28 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.275 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.714 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.2 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.314 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.441 | k star (bias corrected MLE) | 1.49 |
| Theta hat (MLE) | 0.0914 | Theta star (bias corrected MLE) | 0.15 |
| nu hat (MLE) | 34.17 | nu star (bias corrected) | 20.86 |
| Mean (detects) | 0.223 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.0553 |
| Maximum | 0.4 | Median | 0.01 |
| SD | 0.104 | CV | 1.872 |
| k hat (MLE) | 0.583 | k star (bias corrected MLE) | 0.551 |
| Theta hat (MLE) | 0.0948 | Theta star (bias corrected MLE) | 0.1 |
| nu hat (MLE) | 39.65 | nu star (bias corrected) | 37.49 |
| Adjusted Level of Significance (β) | 0.0422 | | |
| Approximate Chi Square Value (37.49, α) | 24.47 | Adjusted Chi Square Value (37.49, β) | 23.95 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0847 | 95% Gamma Adjusted UCL (use when n<50) | 0.0866 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0715 | SD (KM) | 0.104 |
| Variance (KM) | 0.0107 | SE of Mean (KM) | 0.0209 |
| k hat (KM) | 0.477 | k star (KM) | 0.454 |
| nu hat (KM) | 32.4 | nu star (KM) | 30.88 |
| theta hat (KM) | 0.15 | theta star (KM) | 0.158 |
| 80% gamma percentile (KM) | 0.117 | 90% gamma percentile (KM) | 0.197 |
| 95% gamma percentile (KM) | 0.284 | 99% gamma percentile (KM) | 0.5 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (30.88, α) | 19.18 | Adjusted Chi Square Value (30.88, β) | 18.73 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.115 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.118 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.907 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.213 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0635 | Mean in Log Scale | -3.451 |
| SD in Original Scale | 0.1 | SD in Log Scale | 1.034 |
| 95% t UCL (assumes normality of ROS data) | 0.0926 | 95% Percentile Bootstrap UCL | 0.0925 |
| 95% BCA Bootstrap UCL | 0.1 | 95% Bootstrap t UCL | 0.105 |
| 95% H-UCL (Log ROS) | 0.0847 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.315 | KM Geo Mean | 0.0363 |
| KM SD (logged) | 1.01 | 95% Critical H Value (KM-Log) | 2.459 |
| KM Standard Error of Mean (logged) | 0.214 | 95% H-UCL (KM -Log) | 0.0932 |
| KM SD (logged) | 1.01 | 95% Critical H Value (KM-Log) | 2.459 |
| KM Standard Error of Mean (logged) | 0.214 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.117 | Mean in Log Scale | -2.774 |
| SD in Original Scale | 0.139 | SD in Log Scale | 1.164 |
| 95% t UCL (Assumes normality) | 0.158 | 95% H-Stat UCL | 0.21 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.107

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Dibenzo(a,h)anthracene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 34 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 65 | Number of Non-Detects | 4 |
| Number of Distinct Detects | 31 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 0.024 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 0.47 | Maximum Non-Detect | 0.13 |
| Variance Detects | 0.00533 | Percent Non-Detects | 5.797% |
| Mean Detects | 0.14 | SD Detects | 0.073 |
| Median Detects | 0.14 | CV Detects | 0.52 |
| Skewness Detects | 1.874 | Kurtosis Detects | 6.578 |
| Mean of Logged Detects | -2.092 | SD of Logged Detects | 0.538 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.869 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 1.5050E-7 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.189 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.11 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.134 | KM Standard Error of Mean | 0.00912 |
| KM SD | 0.075 | 95% KM (BCA) UCL | 0.15 |
| 95% KM (t) UCL | 0.149 | 95% KM (Percentile Bootstrap) UCL | 0.149 |
| 95% KM (z) UCL | 0.149 | 95% KM Bootstrap t UCL | 0.151 |
| 90% KM Chebyshev UCL | 0.162 | 95% KM Chebyshev UCL | 0.174 |
| 97.5% KM Chebyshev UCL | 0.191 | 99% KM Chebyshev UCL | 0.225 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.986 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.755 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.133 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.111 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.043 | k star (bias corrected MLE) | 3.867 |
| Theta hat (MLE) | 0.0347 | Theta star (bias corrected MLE) | 0.0363 |
| nu hat (MLE) | 525.6 | nu star (bias corrected) | 502.7 |
| Mean (detects) | 0.14 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0166 | Mean | 0.135 |
| Maximum | 0.47 | Median | 0.14 |
| SD | 0.0748 | CV | 0.555 |
| k hat (MLE) | 3.304 | k star (bias corrected MLE) | 3.17 |
| Theta hat (MLE) | 0.0408 | Theta star (bias corrected MLE) | 0.0425 |
| nu hat (MLE) | 455.9 | nu star (bias corrected) | 437.5 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (437.45, α) | 390 | Adjusted Chi Square Value (437.45, β) | 389 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.151 | 95% Gamma Adjusted UCL (use when n<50) | 0.151 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.134 | SD (KM) | 0.075 |
| Variance (KM) | 0.00563 | SE of Mean (KM) | 0.00912 |
| k hat (KM) | 3.199 | k star (KM) | 3.07 |
| nu hat (KM) | 441.5 | nu star (KM) | 423.6 |
| theta hat (KM) | 0.0419 | theta star (KM) | 0.0437 |
| 80% gamma percentile (KM) | 0.191 | 90% gamma percentile (KM) | 0.237 |
| 95% gamma percentile (KM) | 0.28 | 99% gamma percentile (KM) | 0.373 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (423.63, α) | 376.9 | Adjusted Chi Square Value (423.63, β) | 376 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.151 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.151 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.941 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.00666 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.131 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.11 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.135 | Mean in Log Scale | -2.148 |
| SD in Original Scale | 0.0741 | SD in Log Scale | 0.575 |
| 95% t UCL (assumes normality of ROS data) | 0.15 | 95% Percentile Bootstrap UCL | 0.15 |
| 95% BCA Bootstrap UCL | 0.151 | 95% Bootstrap t UCL | 0.153 |
| 95% H-UCL (Log ROS) | 0.157 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.195 | KM Geo Mean | 0.111 |
| KM SD (logged) | 0.704 | 95% Critical H Value (KM-Log) | 2.021 |
| KM Standard Error of Mean (logged) | 0.0876 | 95% H-UCL (KM -Log) | 0.17 |
| KM SD (logged) | 0.704 | 95% Critical H Value (KM-Log) | 2.021 |
| KM Standard Error of Mean (logged) | 0.0876 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.134 | Mean in Log Scale | -2.207 |
| SD in Original Scale | 0.0759 | SD in Log Scale | 0.745 |
| 95% t UCL (Assumes normality) | 0.149 | 95% H-Stat UCL | 0.175 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

### Suggested UCL to Use

95% KM (Chebyshev) UCL 0.174

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Fluoranthene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 44 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 43 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.037 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 6 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 0.751 | Percent Non-Detects | 1.449% |
| Mean Detects | 1.284 | SD Detects | 0.866 |
| Median Detects | 1 | CV Detects | 0.675 |
| Skewness Detects | 2.786 | Kurtosis Detects | 12.36 |
| Mean of Logged Detects | 0.0555 | SD of Logged Detects | 0.692 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.781 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 1.120E-13 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.211 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 1.265 | KM Standard Error of Mean | 0.105 |
| KM SD | 0.867 | 95% KM (BCA) UCL | 1.449 |
| 95% KM (t) UCL | 1.441 | 95% KM (Percentile Bootstrap) UCL | 1.439 |
| 95% KM (z) UCL | 1.438 | 95% KM Bootstrap t UCL | 1.496 |
| 90% KM Chebyshev UCL | 1.581 | 95% KM Chebyshev UCL | 1.724 |
| 97.5% KM Chebyshev UCL | 1.922 | 99% KM Chebyshev UCL | 2.312 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.726 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.759 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.142 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.731 | k star (bias corrected MLE) | 2.62 |
| Theta hat (MLE) | 0.47 | Theta star (bias corrected MLE) | 0.49 |
| nu hat (MLE) | 371.4 | nu star (bias corrected) | 356.3 |
| Mean (detects) | 1.284 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0107 | Mean | 1.265 |
| Maximum | 6 | Median | 1 |
| SD | 0.874 | CV | 0.69 |
| k hat (MLE) | 2.182 | k star (bias corrected MLE) | 2.097 |
| Theta hat (MLE) | 0.58 | Theta star (bias corrected MLE) | 0.603 |
| nu hat (MLE) | 301.1 | nu star (bias corrected) | 289.4 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (289.38, α) | 251 | Adjusted Chi Square Value (289.38, β) | 250.2 |
| 95% Gamma Approximate UCL (use when n>=50) | 1.459 | 95% Gamma Adjusted UCL (use when n<50) | 1.463 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 1.265 | SD (KM) | 0.867 |
| Variance (KM) | 0.752 | SE of Mean (KM) | 0.105 |
| k hat (KM) | 2.128 | k star (KM) | 2.045 |
| nu hat (KM) | 293.7 | nu star (KM) | 282.2 |
| theta hat (KM) | 0.595 | theta star (KM) | 0.619 |
| 80% gamma percentile (KM) | 1.889 | 90% gamma percentile (KM) | 2.448 |
| 95% gamma percentile (KM) | 2.98 | 99% gamma percentile (KM) | 4.158 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (282.22, α) | 244.3 | Adjusted Chi Square Value (282.22, β) | 243.6 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.461 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.466 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.887 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 1.1059E-6 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.182 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.268 | Mean in Log Scale | 0.0312 |
| SD in Original Scale | 0.87 | SD in Log Scale | 0.716 |
| 95% t UCL (assumes normality of ROS data) | 1.443 | 95% Percentile Bootstrap UCL | 1.455 |
| 95% BCA Bootstrap UCL | 1.486 | 95% Bootstrap t UCL | 1.498 |
| 95% H-UCL (Log ROS) | 1.591 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.0178 | KM Geo Mean | 0.982 |
| KM SD (logged) | 0.912 | 95% Critical H Value (KM-Log) | 2.203 |
| KM Standard Error of Mean (logged) | 0.111 | 95% H-UCL (KM -Log) | 1.899 |
| KM SD (logged) | 0.912 | 95% Critical H Value (KM-Log) | 2.203 |
| KM Standard Error of Mean (logged) | 0.111 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 1.265 | Mean in Log Scale | -0.0279 |
| SD in Original Scale | 0.874 | SD in Log Scale | 0.976 |
| 95% t UCL (Assumes normality) | 1.44 | 95% H-Stat UCL | 2.041 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 1.724

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Fluorene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 52 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 58 | Number of Non-Detects | 11 |
| Number of Distinct Detects | 44 | Number of Distinct Non-Detects | 10 |
| Minimum Detect | 0.012 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 0.41 | Maximum Non-Detect | 0.27 |
| Variance Detects | 0.00302 | Percent Non-Detects | 15.94% |
| Mean Detects | 0.0631 | SD Detects | 0.0549 |
| Median Detects | 0.051 | CV Detects | 0.871 |
| Skewness Detects | 4.751 | Kurtosis Detects | 28.5 |
| Mean of Logged Detects | -2.953 | SD of Logged Detects | 0.579 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.578 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.211 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.116 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0604 | KM Standard Error of Mean | 0.00639 |
| KM SD | 0.0516 | 95% KM (BCA) UCL | 0.0735 |
| 95% KM (t) UCL | 0.071 | 95% KM (Percentile Bootstrap) UCL | 0.0716 |
| 95% KM (z) UCL | 0.0709 | 95% KM Bootstrap t UCL | 0.08 |
| 90% KM Chebyshev UCL | 0.0796 | 95% KM Chebyshev UCL | 0.0882 |
| 97.5% KM Chebyshev UCL | 0.1 | 99% KM Chebyshev UCL | 0.124 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.392 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.759 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.129 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.118 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.797 | k star (bias corrected MLE) | 2.664 |
| Theta hat (MLE) | 0.0225 | Theta star (bias corrected MLE) | 0.0237 |
| nu hat (MLE) | 324.5 | nu star (bias corrected) | 309 |
| Mean (detects) | 0.0631 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.0597 |
| Maximum | 0.41 | Median | 0.0506 |
| SD | 0.0513 | CV | 0.859 |
| k hat (MLE) | 2.827 | k star (bias corrected MLE) | 2.714 |
| Theta hat (MLE) | 0.0211 | Theta star (bias corrected MLE) | 0.022 |
| nu hat (MLE) | 390.1 | nu star (bias corrected) | 374.5 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (374.48, α) | 330.6 | Adjusted Chi Square Value (374.48, β) | 329.8 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0677 | 95% Gamma Adjusted UCL (use when n<50) | 0.0678 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0604 | SD (KM) | 0.0516 |
| Variance (KM) | 0.00266 | SE of Mean (KM) | 0.00639 |
| k hat (KM) | 1.37 | k star (KM) | 1.32 |
| nu hat (KM) | 189 | nu star (KM) | 182.1 |
| theta hat (KM) | 0.0441 | theta star (KM) | 0.0458 |
| 80% gamma percentile (KM) | 0.0947 | 90% gamma percentile (KM) | 0.13 |
| 95% gamma percentile (KM) | 0.164 | 99% gamma percentile (KM) | 0.243 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (182.14, α) | 151.9 | Adjusted Chi Square Value (182.14, β) | 151.3 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0724 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0727 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.964 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.175 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0845 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.116 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0599 | Mean in Log Scale | -2.995 |
| SD in Original Scale | 0.0511 | SD in Log Scale | 0.566 |
| 95% t UCL (assumes normality of ROS data) | 0.0701 | 95% Percentile Bootstrap UCL | 0.0705 |
| 95% BCA Bootstrap UCL | 0.0746 | 95% Bootstrap t UCL | 0.0785 |
| 95% H-UCL (Log ROS) | 0.067 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.009 | KM Geo Mean | 0.0493 |
| KM SD (logged) | 0.623 | 95% Critical H Value (KM-Log) | 1.957 |
| KM Standard Error of Mean (logged) | 0.0805 | 95% H-UCL (KM -Log) | 0.0694 |
| KM SD (logged) | 0.623 | 95% Critical H Value (KM-Log) | 1.957 |
| KM Standard Error of Mean (logged) | 0.0805 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0665 | Mean in Log Scale | -2.933 |
| SD in Original Scale | 0.0544 | SD in Log Scale | 0.691 |
| 95% t UCL (Assumes normality) | 0.0774 | 95% H-Stat UCL | 0.08 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Lognormal Distributed at 5% Significance Level**

**Suggested UCL to Use**

KM H-UCL 0.0694

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_SVOCs|Indeno(1,2,3-cd)pyrene

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 47 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 46 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.022 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 1.4 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 0.076 | Percent Non-Detects | 1.449% |
| Mean Detects | 0.516 | SD Detects | 0.276 |
| Median Detects | 0.46 | CV Detects | 0.534 |
| Skewness Detects | 1.059 | Kurtosis Detects | 1.667 |
| Mean of Logged Detects | -0.832 | SD of Logged Detects | 0.671 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.92 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 2.0660E-4 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.147 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.509 | KM Standard Error of Mean | 0.0338 |
| KM SD | 0.278 | 95% KM (BCA) UCL | 0.566 |
| 95% KM (t) UCL | 0.565 | 95% KM (Percentile Bootstrap) UCL | 0.564 |
| 95% KM (z) UCL | 0.564 | 95% KM Bootstrap t UCL | 0.571 |
| 90% KM Chebyshev UCL | 0.61 | 95% KM Chebyshev UCL | 0.656 |
| 97.5% KM Chebyshev UCL | 0.719 | 99% KM Chebyshev UCL | 0.844 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 1.205 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.757 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.14 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.094 | k star (bias corrected MLE) | 2.967 |
| Theta hat (MLE) | 0.167 | Theta star (bias corrected MLE) | 0.174 |
| nu hat (MLE) | 420.7 | nu star (bias corrected) | 403.5 |
| Mean (detects) | 0.516 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.022 | Mean | 0.51 |
| Maximum | 1.4 | Median | 0.44 |
| SD | 0.279 | CV | 0.547 |
| k hat (MLE) | 2.875 | k star (bias corrected MLE) | 2.76 |
| Theta hat (MLE) | 0.177 | Theta star (bias corrected MLE) | 0.185 |
| nu hat (MLE) | 396.7 | nu star (bias corrected) | 380.8 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (380.83, α) | 336.6 | Adjusted Chi Square Value (380.83, β) | 335.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.577 | 95% Gamma Adjusted UCL (use when n<50) | 0.578 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.509 | SD (KM) | 0.278 |
| Variance (KM) | 0.0775 | SE of Mean (KM) | 0.0338 |
| k hat (KM) | 3.34 | k star (KM) | 3.205 |
| nu hat (KM) | 461 | nu star (KM) | 442.3 |
| theta hat (KM) | 0.152 | theta star (KM) | 0.159 |
| 80% gamma percentile (KM) | 0.72 | 90% gamma percentile (KM) | 0.89 |
| 95% gamma percentile (KM) | 1.048 | 99% gamma percentile (KM) | 1.389 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (442.25, α) | 394.5 | Adjusted Chi Square Value (442.25, β) | 393.5 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.57 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.572 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.886 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk P Value | 8.6532E-7 | Detected Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.185 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level | |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.51 | Mean in Log Scale | -0.856 |
| SD in Original Scale | 0.278 | SD in Log Scale | 0.695 |
| 95% t UCL (assumes normality of ROS data) | 0.566 | 95% Percentile Bootstrap UCL | 0.566 |
| 95% BCA Bootstrap UCL | 0.57 | 95% Bootstrap t UCL | 0.568 |
| 95% H-UCL (Log ROS) | 0.641 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.892 | KM Geo Mean | 0.41 |
| KM SD (logged) | 0.829 | 95% Critical H Value (KM-Log) | 2.128 |
| KM Standard Error of Mean (logged) | 0.1 | 95% H-UCL (KM -Log) | 0.715 |
| KM SD (logged) | 0.829 | 95% Critical H Value (KM-Log) | 2.128 |
| KM Standard Error of Mean (logged) | 0.1 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.509 | Mean in Log Scale | -0.902 |
| SD in Original Scale | 0.28 | SD in Log Scale | 0.887 |
| 95% t UCL (Assumes normality) | 0.565 | 95% H-Stat UCL | 0.761 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 0.656

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs|Naphthalene

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 49 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 37 | Number of Non-Detects | 32 |
| Number of Distinct Detects | 25 | Number of Distinct Non-Detects | 28 |
| Minimum Detect | 0.0049 | Minimum Non-Detect | 0.0058 |
| Maximum Detect | 0.13 | Maximum Non-Detect | 0.27 |
| Variance Detects | 7.0260E-4 | Percent Non-Detects | 46.38% |
| Mean Detects | 0.0373 | SD Detects | 0.0265 |
| Median Detects | 0.027 | CV Detects | 0.711 |
| Skewness Detects | 1.852 | Kurtosis Detects | 3.595 |
| Mean of Logged Detects | -3.49 | SD of Logged Detects | 0.639 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.804 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.936 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.204 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.144 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.0293 | KM Standard Error of Mean | 0.0034 |
| KM SD | 0.0246 | 95% KM (BCA) UCL | 0.0353 |
| 95% KM (t) UCL | 0.035 | 95% KM (Percentile Bootstrap) UCL | 0.0352 |
| 95% KM (z) UCL | 0.0349 | 95% KM Bootstrap t UCL | 0.0359 |
| 90% KM Chebyshev UCL | 0.0395 | 95% KM Chebyshev UCL | 0.0441 |
| 97.5% KM Chebyshev UCL | 0.0505 | 99% KM Chebyshev UCL | 0.0631 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.974 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.756 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.153 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.146 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.647 | k star (bias corrected MLE) | 2.45 |
| Theta hat (MLE) | 0.0141 | Theta star (bias corrected MLE) | 0.0152 |
| nu hat (MLE) | 195.9 | nu star (bias corrected) | 181.3 |
| Mean (detects) | 0.0373 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0049 | Mean | 0.0285 |
| Maximum | 0.13 | Median | 0.022 |
| SD | 0.022 | CV | 0.772 |
| k hat (MLE) | 2.613 | k star (bias corrected MLE) | 2.509 |
| Theta hat (MLE) | 0.0109 | Theta star (bias corrected MLE) | 0.0114 |
| nu hat (MLE) | 360.6 | nu star (bias corrected) | 346.2 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (346.22, α) | 304.1 | Adjusted Chi Square Value (346.22, β) | 303.3 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0325 | 95% Gamma Adjusted UCL (use when n<50) | 0.0326 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0293 | SD (KM) | 0.0246 |
| Variance (KM) | 6.0719E-4 | SE of Mean (KM) | 0.0034 |
| k hat (KM) | 1.413 | k star (KM) | 1.361 |
| nu hat (KM) | 194.9 | nu star (KM) | 187.8 |
| theta hat (KM) | 0.0207 | theta star (KM) | 0.0215 |
| 80% gamma percentile (KM) | 0.0458 | 90% gamma percentile (KM) | 0.0625 |
| 95% gamma percentile (KM) | 0.0788 | 99% gamma percentile (KM) | 0.116 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (187.80, α) | 157.1 | Adjusted Chi Square Value (187.80, β) | 156.5 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.035 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0351 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.936 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.116 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.144 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0285 | Mean in Log Scale | -3.764 |
| SD in Original Scale | 0.022 | SD in Log Scale | 0.622 |
| 95% t UCL (assumes normality of ROS data) | 0.0329 | 95% Percentile Bootstrap UCL | 0.0332 |
| 95% BCA Bootstrap UCL | 0.0336 | 95% Bootstrap t UCL | 0.034 |
| 95% H-UCL (Log ROS) | 0.0326 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.877 | KM Geo Mean | 0.0207 |
| KM SD (logged) | 0.886 | 95% Critical H Value (KM-Log) | 2.182 |
| KM Standard Error of Mean (logged) | 0.131 | 95% H-UCL (KM -Log) | 0.0388 |
| KM SD (logged) | 0.886 | 95% Critical H Value (KM-Log) | 2.182 |
| KM Standard Error of Mean (logged) | 0.131 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.042 | Mean in Log Scale | -3.559 |
| SD in Original Scale | 0.0357 | SD in Log Scale | 0.985 |
| 95% t UCL (Assumes normality) | 0.0492 | 95% H-Stat UCL | 0.0604 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Lognormal Distributed at 5% Significance Level**

**Suggested UCL to Use**

KM H-UCL 0.0388

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_SVOCs|Phenanthrene

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 42 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 67 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 40 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.092 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 4.4 | Maximum Non-Detect | 0.042 |
| Variance Detects | 0.337 | Percent Non-Detects | 2.899% |
| Mean Detects | 0.558 | SD Detects | 0.581 |
| Median Detects | 0.4 | CV Detects | 1.04 |
| Skewness Detects | 4.935 | Kurtosis Detects | 29.79 |
| Mean of Logged Detects | -0.808 | SD of Logged Detects | 0.595 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.524 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 0 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.266 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.108 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.542 | KM Standard Error of Mean | 0.0698 |
| KM SD | 0.576 | 95% KM (BCA) UCL | 0.679 |
| 95% KM (t) UCL | 0.659 | 95% KM (Percentile Bootstrap) UCL | 0.673 |
| 95% KM (z) UCL | 0.657 | 95% KM Bootstrap t UCL | 0.769 |
| 90% KM Chebyshev UCL | 0.752 | 95% KM Chebyshev UCL | 0.847 |
| 97.5% KM Chebyshev UCL | 0.978 | 99% KM Chebyshev UCL | 1.237 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 3.286 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.761 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.159 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.11 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.368 | k star (bias corrected MLE) | 2.272 |
| Theta hat (MLE) | 0.236 | Theta star (bias corrected MLE) | 0.246 |
| nu hat (MLE) | 317.4 | nu star (bias corrected) | 304.5 |
| Mean (detects) | 0.558 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.542 |
| Maximum | 4.4 | Median | 0.4 |
| SD | 0.58 | CV | 1.068 |
| k hat (MLE) | 1.778 | k star (bias corrected MLE) | 1.71 |
| Theta hat (MLE) | 0.305 | Theta star (bias corrected MLE) | 0.317 |
| nu hat (MLE) | 245.3 | nu star (bias corrected) | 236 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (235.99, α) | 201.4 | Adjusted Chi Square Value (235.99, β) | 200.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.636 | 95% Gamma Adjusted UCL (use when n<50) | 0.638 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.542 | SD (KM) | 0.576 |
| Variance (KM) | 0.331 | SE of Mean (KM) | 0.0698 |
| k hat (KM) | 0.888 | k star (KM) | 0.859 |
| nu hat (KM) | 122.6 | nu star (KM) | 118.6 |
| theta hat (KM) | 0.611 | theta star (KM) | 0.631 |
| 80% gamma percentile (KM) | 0.883 | 90% gamma percentile (KM) | 1.296 |
| 95% gamma percentile (KM) | 1.715 | 99% gamma percentile (KM) | 2.698 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (118.58, α) | 94.44 | Adjusted Chi Square Value (118.58, β) | 93.98 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.681 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.684 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.939 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.00401 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.109 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.108 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.545 | Mean in Log Scale | -0.85 |
| SD in Original Scale | 0.577 | SD in Log Scale | 0.633 |
| 95% t UCL (assumes normality of ROS data) | 0.661 | 95% Percentile Bootstrap UCL | 0.674 |
| 95% BCA Bootstrap UCL | 0.717 | 95% Bootstrap t UCL | 0.765 |
| 95% H-UCL (Log ROS) | 0.608 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.93 | KM Geo Mean | 0.395 |
| KM SD (logged) | 0.914 | 95% Critical H Value (KM-Log) | 2.205 |
| KM Standard Error of Mean (logged) | 0.111 | 95% H-UCL (KM -Log) | 0.765 |
| KM SD (logged) | 0.914 | 95% Critical H Value (KM-Log) | 2.205 |
| KM Standard Error of Mean (logged) | 0.111 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.543 | Mean in Log Scale | -0.924 |
| SD in Original Scale | 0.58 | SD in Log Scale | 0.905 |
| 95% t UCL (Assumes normality) | 0.659 | 95% H-Stat UCL | 0.761 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 0.847

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_SVOCs|Pyrene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 69 | Number of Distinct Observations | 43 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 68 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 42 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.036 | Minimum Non-Detect | 0.0067 |
| Maximum Detect | 4 | Maximum Non-Detect | 0.0067 |
| Variance Detects | 0.303 | Percent Non-Detects | 1.449% |
| Mean Detects | 0.998 | SD Detects | 0.551 |
| Median Detects | 0.91 | CV Detects | 0.551 |
| Skewness Detects | 2.652 | Kurtosis Detects | 12.53 |
| Mean of Logged Detects | -0.147 | SD of Logged Detects | 0.615 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.816 | **Normal GOF Test on Detected Observations Only** |
| 5% Shapiro Wilk P Value | 1.805E-11 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.191 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.984 | KM Standard Error of Mean | 0.0673 |
| KM SD | 0.555 | 95% KM (BCA) UCL | 1.107 |
| 95% KM (t) UCL | 1.096 | 95% KM (Percentile Bootstrap) UCL | 1.104 |
| 95% KM (z) UCL | 1.095 | 95% KM Bootstrap t UCL | 1.126 |
| 90% KM Chebyshev UCL | 1.186 | 95% KM Chebyshev UCL | 1.277 |
| 97.5% KM Chebyshev UCL | 1.404 | 99% KM Chebyshev UCL | 1.654 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.662 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.756 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.15 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.109 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.612 | k star (bias corrected MLE) | 3.463 |
| Theta hat (MLE) | 0.276 | Theta star (bias corrected MLE) | 0.288 |
| nu hat (MLE) | 491.3 | nu star (bias corrected) | 470.9 |
| Mean (detects) | 0.998 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.036 | Mean | 0.986 |
| Maximum | 4 | Median | 0.91 |
| SD | 0.556 | CV | 0.564 |
| k hat (MLE) | 3.291 | k star (bias corrected MLE) | 3.158 |
| Theta hat (MLE) | 0.299 | Theta star (bias corrected MLE) | 0.312 |
| nu hat (MLE) | 454.2 | nu star (bias corrected) | 435.8 |
| Adjusted Level of Significance (β) | 0.0465 | | |
| Approximate Chi Square Value (435.79, α) | 388.4 | Adjusted Chi Square Value (435.79, β) | 387.4 |
| 95% Gamma Approximate UCL (use when n>=50) | 1.106 | 95% Gamma Adjusted UCL (use when n<50) | 1.109 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.984 | SD (KM) | 0.555 |
| Variance (KM) | 0.308 | SE of Mean (KM) | 0.0673 |
| k hat (KM) | 3.14 | k star (KM) | 3.013 |
| nu hat (KM) | 433.3 | nu star (KM) | 415.8 |
| theta hat (KM) | 0.313 | theta star (KM) | 0.327 |
| 80% gamma percentile (KM) | 1.403 | 90% gamma percentile (KM) | 1.744 |
| 95% gamma percentile (KM) | 2.062 | 99% gamma percentile (KM) | 2.752 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (415.78, α) | 369.5 | Adjusted Chi Square Value (415.78, β) | 368.6 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.107 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.11 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Approximate Test Statistic | 0.851 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk P Value | 3.7606E-9 | Detected Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.193 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.107 | Detected Data Not Lognormal at 5% Significance Level | |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.987 | Mean in Log Scale | -0.167 |
| SD in Original Scale | 0.555 | SD in Log Scale | 0.635 |
| 95% t UCL (assumes normality of ROS data) | 1.098 | 95% Percentile Bootstrap UCL | 1.101 |
| 95% BCA Bootstrap UCL | 1.127 | 95% Bootstrap t UCL | 1.135 |
| 95% H-UCL (Log ROS) | 1.204 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.217 | KM Geo Mean | 0.805 |
| KM SD (logged) | 0.84 | 95% Critical H Value (KM-Log) | 2.138 |
| KM Standard Error of Mean (logged) | 0.102 | 95% H-UCL (KM -Log) | 1.424 |
| KM SD (logged) | 0.84 | 95% Critical H Value (KM-Log) | 2.138 |
| KM Standard Error of Mean (logged) | 0.102 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.984 | Mean in Log Scale | -0.227 |
| SD in Original Scale | 0.559 | SD in Log Scale | 0.905 |
| 95% t UCL (Assumes normality) | 1.096 | 95% H-Stat UCL | 1.529 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 1.277

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|1-Methylnaphthalene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 30 |
| | | Number of Missing Observations | 40 |
| Number of Detects | 34 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 28 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 0.015 | Minimum Non-Detect | 0.014 |
| Maximum Detect | 0.239 | Maximum Non-Detect | 0.065 |
| Variance Detects | 0.00293 | Percent Non-Detects | 12.82% |
| Mean Detects | 0.0582 | SD Detects | 0.0541 |
| Median Detects | 0.04 | CV Detects | 0.93 |
| Skewness Detects | 1.983 | Kurtosis Detects | 3.954 |
| Mean of Logged Detects | -3.163 | SD of Logged Detects | 0.775 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.751 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.933 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.237 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.15 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0533 | KM Standard Error of Mean | 0.00837 |
| KM SD | 0.0515 | 95% KM (BCA) UCL | 0.0683 |
| 95% KM (t) UCL | 0.0674 | 95% KM (Percentile Bootstrap) UCL | 0.068 |
| 95% KM (z) UCL | 0.0671 | 95% KM Bootstrap t UCL | 0.0728 |
| 90% KM Chebyshev UCL | 0.0784 | 95% KM Chebyshev UCL | 0.0898 |
| 97.5% KM Chebyshev UCL | 0.106 | 99% KM Chebyshev UCL | 0.137 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.183 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.763 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.162 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.153 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.716 | k star (bias corrected MLE) | 1.584 |
| Theta hat (MLE) | 0.0339 | Theta star (bias corrected MLE) | 0.0368 |
| nu hat (MLE) | 116.7 | nu star (bias corrected) | 107.7 |
| Mean (detects) | 0.0582 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.0525 |
| Maximum | 0.239 | Median | 0.028 |
| SD | 0.0527 | CV | 1.003 |
| k hat (MLE) | 1.5 | k star (bias corrected MLE) | 1.402 |
| Theta hat (MLE) | 0.035 | Theta star (bias corrected MLE) | 0.0374 |
| nu hat (MLE) | 117 | nu star (bias corrected) | 109.3 |
| Adjusted Level of Significance (β) | 0.0437 | | |
| Approximate Chi Square Value (109.34, α) | 86.2 | Adjusted Chi Square Value (109.34, β) | 85.39 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0666 | 95% Gamma Adjusted UCL (use when n<50) | 0.0672 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0533 | SD (KM) | 0.0515 |
| Variance (KM) | 0.00265 | SE of Mean (KM) | 0.00837 |
| k hat (KM) | 1.074 | k star (KM) | 1.008 |
| nu hat (KM) | 83.77 | nu star (KM) | 78.66 |
| theta hat (KM) | 0.0497 | theta star (KM) | 0.0529 |
| 80% gamma percentile (KM) | 0.0858 | 90% gamma percentile (KM) | 0.123 |
| 95% gamma percentile (KM) | 0.159 | 99% gamma percentile (KM) | 0.245 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (78.66, α) | 59.23 | Adjusted Chi Square Value (78.66, β) | 58.56 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0708 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0716 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.931 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.933 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.144 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.15 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0531 | Mean in Log Scale | -3.287 |
| SD in Original Scale | 0.0523 | SD in Log Scale | 0.817 |
| 95% t UCL (assumes normality of ROS data) | 0.0672 | 95% Percentile Bootstrap UCL | 0.067 |
| 95% BCA Bootstrap UCL | 0.0703 | 95% Bootstrap t UCL | 0.0727 |
| 95% H-UCL (Log ROS) | 0.0698 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.265 | KM Geo Mean | 0.0382 |
| KM SD (logged) | 0.769 | 95% Critical H Value (KM-Log) | 2.154 |
| KM Standard Error of Mean (logged) | 0.126 | 95% H-UCL (KM -Log) | 0.0671 |
| KM SD (logged) | 0.769 | 95% Critical H Value (KM-Log) | 2.154 |
| KM Standard Error of Mean (logged) | 0.126 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0528 | Mean in Log Scale | -3.304 |
| SD in Original Scale | 0.0525 | SD in Log Scale | 0.832 |
| 95% t UCL (Assumes normality) | 0.067 | 95% H-Stat UCL | 0.0701 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Lognormal Distributed at 5% Significance Level**

**Suggested UCL to Use**

KM H-UCL 0.0671

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|2,3,5-Trimethylnaphthalene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 22 | Number of Distinct Observations | 21 |
| | | Number of Missing Observations | 57 |
| Minimum | 0.0089 | Mean | 0.0641 |
| Maximum | 0.39 | Median | 0.032 |
| SD | 0.0835 | Std. Error of Mean | 0.0178 |
| Coefficient of Variation | 1.302 | Skewness | 3.137 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.623 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.911 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.254 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.184 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.0948 | 95% Adjusted-CLT UCL (Chen-1995) | 0.106 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.0967 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.724 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.768 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.155 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.19 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.122 | k star (bias corrected MLE) | 1 |
| Theta hat (MLE) | 0.0571 | Theta star (bias corrected MLE) | 0.0641 |
| nu hat (MLE) | 49.39 | nu star (bias corrected) | 43.99 |
| MLE Mean (bias corrected) | 0.0641 | MLE Sd (bias corrected) | 0.0641 |
| | | Approximate Chi Square Value (0.05) | 29.78 |
| Adjusted Level of Significance | 0.0386 | Adjusted Chi Square Value | 28.9 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.0947 | 95% Adjusted Gamma UCL (use when n<50) | 0.0976 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.955 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.911 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.105 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.184 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -4.722 | Mean of logged Data | -3.254 |
| Maximum of Logged Data | -0.942 | SD of logged Data | 0.982 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.108 | 90% Chebyshev (MVUE) UCL | 0.103 |
| 95% Chebyshev (MVUE) UCL | 0.123 | 97.5% Chebyshev (MVUE) UCL | 0.15 |
| 99% Chebyshev (MVUE) UCL | 0.202 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.0934 | 95% Jackknife UCL | 0.0948 |
| 95% Standard Bootstrap UCL | 0.0922 | 95% Bootstrap-t UCL | 0.123 |
| 95% Hall's Bootstrap UCL | 0.223 | 95% Percentile Bootstrap UCL | 0.0958 |
| 95% BCA Bootstrap UCL | 0.105 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.118 | 95% Chebyshev(Mean, Sd) UCL | 0.142 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.175 | 99% Chebyshev(Mean, Sd) UCL | 0.241 |

**Suggested UCL to Use**

95% Adjusted Gamma UCL 0.0976

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|2,6-Dimethylnaphthalene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 22 | Number of Distinct Observations | 21 |
| | | Number of Missing Observations | 57 |
| Minimum | 0.016 | Mean | 0.093 |
| Maximum | 0.3 | Median | 0.054 |
| SD | 0.0841 | Std. Error of Mean | 0.0179 |
| Coefficient of Variation | 0.904 | Skewness | 1.45 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.803 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.911 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.23 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.184 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.124 | 95% Adjusted-CLT UCL (Chen-1995) | 0.128 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.125 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.631 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.758 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.163 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.188 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.546 | k star (bias corrected MLE) | 1.365 |
| Theta hat (MLE) | 0.0602 | Theta star (bias corrected MLE) | 0.0681 |
| nu hat (MLE) | 68 | nu star (bias corrected) | 60.06 |
| MLE Mean (bias corrected) | 0.093 | MLE Sd (bias corrected) | 0.0796 |
| | | Approximate Chi Square Value (0.05) | 43.24 |
| Adjusted Level of Significance | 0.0386 | Adjusted Chi Square Value | 42.18 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.129 | 95% Adjusted Gamma UCL (use when n<50) | 0.132 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.957 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.911 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.121 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.184 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -4.135 | Mean of logged Data | -2.732 |
| Maximum of Logged Data | -1.204 | SD of logged Data | 0.862 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.148 | 90% Chebyshev (MVUE) UCL | 0.148 |
| 95% Chebyshev (MVUE) UCL | 0.174 | 97.5% Chebyshev (MVUE) UCL | 0.209 |
| 99% Chebyshev (MVUE) UCL | 0.278 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.123 | 95% Jackknife UCL | 0.124 |
| 95% Standard Bootstrap UCL | 0.122 | 95% Bootstrap-t UCL | 0.135 |
| 95% Hall's Bootstrap UCL | 0.135 | 95% Percentile Bootstrap UCL | 0.124 |
| 95% BCA Bootstrap UCL | 0.125 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.147 | 95% Chebyshev(Mean, Sd) UCL | 0.171 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.205 | 99% Chebyshev(Mean, Sd) UCL | 0.271 |

Suggested UCL to Use

95% Adjusted Gamma UCL 0.132

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|2-Methylnaphthalene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 27 |
| | | Number of Missing Observations | 40 |
| Number of Detects | 26 | Number of Non-Detects | 13 |
| Number of Distinct Detects | 23 | Number of Distinct Non-Detects | 10 |
| Minimum Detect | 0.029 | Minimum Non-Detect | 0.029 |
| Maximum Detect | 0.4 | Maximum Non-Detect | 0.15 |
| Variance Detects | 0.00839 | Percent Non-Detects | 33.33% |
| Mean Detects | 0.112 | SD Detects | 0.0916 |
| Median Detects | 0.085 | CV Detects | 0.82 |
| Skewness Detects | 1.907 | Kurtosis Detects | 3.786 |
| Mean of Logged Detects | -2.448 | SD of Logged Detects | 0.706 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.78 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.92 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.209 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.17 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0877 | KM Standard Error of Mean | 0.0134 |
| KM SD | 0.0817 | 95% KM (BCA) UCL | 0.113 |
| 95% KM (t) UCL | 0.11 | 95% KM (Percentile Bootstrap) UCL | 0.11 |
| 95% KM (z) UCL | 0.11 | 95% KM Bootstrap t UCL | 0.119 |
| 90% KM Chebyshev UCL | 0.128 | 95% KM Chebyshev UCL | 0.146 |
| 97.5% KM Chebyshev UCL | 0.172 | 99% KM Chebyshev UCL | 0.222 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.682 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.757 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.142 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.173 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.107 | k star (bias corrected MLE) | 1.889 |
| Theta hat (MLE) | 0.053 | Theta star (bias corrected MLE) | 0.0591 |
| nu hat (MLE) | 109.6 | nu star (bias corrected) | 98.25 |
| Mean (detects) | 0.112 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.0811 |
| Maximum | 0.4 | Median | 0.046 |
| SD | 0.0868 | CV | 1.07 |
| k hat (MLE) | 1.125 | k star (bias corrected MLE) | 1.056 |
| Theta hat (MLE) | 0.0721 | Theta star (bias corrected MLE) | 0.0768 |
| nu hat (MLE) | 87.77 | nu star (bias corrected) | 82.36 |
| Adjusted Level of Significance (β) | 0.0437 | | |
| Approximate Chi Square Value (82.36, α) | 62.44 | Adjusted Chi Square Value (82.36, β) | 61.76 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.107 | 95% Gamma Adjusted UCL (use when n<50) | 0.108 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0877 | SD (KM) | 0.0817 |
| Variance (KM) | 0.00667 | SE of Mean (KM) | 0.0134 |
| k hat (KM) | 1.155 | k star (KM) | 1.083 |
| nu hat (KM) | 90.08 | nu star (KM) | 84.48 |
| theta hat (KM) | 0.076 | theta star (KM) | 0.081 |
| 80% gamma percentile (KM) | 0.14 | 90% gamma percentile (KM) | 0.198 |
| 95% gamma percentile (KM) | 0.256 | 99% gamma percentile (KM) | 0.388 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (84.48, α) | 64.3 | Adjusted Chi Square Value (84.48, β) | 63.6 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.115 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.117 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.953 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.92 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.122 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.17 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0852 | Mean in Log Scale | -2.81 |
| SD in Original Scale | 0.0839 | SD in Log Scale | 0.813 |
| 95% t UCL (assumes normality of ROS data) | 0.108 | 95% Percentile Bootstrap UCL | 0.109 |
| 95% BCA Bootstrap UCL | 0.114 | 95% Bootstrap t UCL | 0.115 |
| 95% H-UCL (Log ROS) | 0.112 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.733 | KM Geo Mean | 0.065 |
| KM SD (logged) | 0.725 | 95% Critical H Value (KM-Log) | 2.111 |
| KM Standard Error of Mean (logged) | 0.122 | 95% H-UCL (KM -Log) | 0.108 |
| KM SD (logged) | 0.725 | 95% Critical H Value (KM-Log) | 2.111 |
| KM Standard Error of Mean (logged) | 0.122 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0866 | Mean in Log Scale | -2.799 |
| SD in Original Scale | 0.0836 | SD in Log Scale | 0.841 |
| 95% t UCL (Assumes normality) | 0.109 | 95% H-Stat UCL | 0.118 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Gamma Distributed at 5% Significance Level

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 0.117 | 95% GROS Adjusted Gamma UCL | 0.108 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Acenaphthene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 33 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.0167 | Mean | 0.0436 |
| Maximum | 0.122 | Median | 0.037 |
| SD | 0.0237 | Std. Error of Mean | 0.0038 |
| Coefficient of Variation | 0.545 | Skewness | 1.588 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.842 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.186 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.05 | 95% Adjusted-CLT UCL (Chen-1995) | 0.0509 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.0501 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.787 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.752 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.118 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.38 | k star (bias corrected MLE) | 4.06 |
| Theta hat (MLE) | 0.00995 | Theta star (bias corrected MLE) | 0.0107 |
| nu hat (MLE) | 341.6 | nu star (bias corrected) | 316.7 |
| MLE Mean (bias corrected) | 0.0436 | MLE Sd (bias corrected) | 0.0216 |
| | | Approximate Chi Square Value (0.05) | 276.5 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 275 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.0499 | 95% Adjusted Gamma UCL (use when n<50) | 0.0502 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.964 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0853 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -4.092 | Mean of logged Data | -3.252 |
| Maximum of Logged Data | -2.104 | SD of logged Data | 0.476 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.0502 | 90% Chebyshev (MVUE) UCL | 0.0535 |
| 95% Chebyshev (MVUE) UCL | 0.0582 | 97.5% Chebyshev (MVUE) UCL | 0.0647 |
| 99% Chebyshev (MVUE) UCL | 0.0774 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.0498 | 95% Jackknife UCL | 0.05 |
| 95% Standard Bootstrap UCL | 0.0498 | 95% Bootstrap-t UCL | 0.0514 |
| 95% Hall's Bootstrap UCL | 0.0512 | 95% Percentile Bootstrap UCL | 0.05 |
| 95% BCA Bootstrap UCL | 0.0509 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.055 | 95% Chebyshev(Mean, Sd) UCL | 0.0601 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.0673 | 99% Chebyshev(Mean, Sd) UCL | 0.0814 |

**Suggested UCL to Use**

95% Adjusted Gamma UCL 0.0502

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Acenaphthylene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.011 | Mean | 0.0272 |
| Maximum | 0.13 | Median | 0.024 |
| SD | 0.0182 | Std. Error of Mean | 0.00292 |
| Coefficient of Variation | 0.671 | Skewness | 4.977 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.476 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.303 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.0321 | 95% Adjusted-CLT UCL (Chen-1995) | 0.0345 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.0325 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 3.131 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.244 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.326 | k star (bias corrected MLE) | 4.933 |
| Theta hat (MLE) | 0.00511 | Theta star (bias corrected MLE) | 0.00551 |
| nu hat (MLE) | 415.4 | nu star (bias corrected) | 384.8 |
| MLE Mean (bias corrected) | 0.0272 | MLE Sd (bias corrected) | 0.0122 |
| | | Approximate Chi Square Value (0.05) | 340.3 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 338.7 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.0307 | 95% Adjusted Gamma UCL (use when n<50) | 0.0309 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.826 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.202 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -4.51 | Mean of logged Data | -3.702 |
| Maximum of Logged Data | -2.04 | SD of logged Data | 0.381 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.0297 | 90% Chebyshev (MVUE) UCL | 0.0315 |
| 95% Chebyshev (MVUE) UCL | 0.0337 | 97.5% Chebyshev (MVUE) UCL | 0.0369 |
| 99% Chebyshev (MVUE) UCL | 0.043 | | |

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.032 | 95% Jackknife UCL | 0.0321 |
| 95% Standard Bootstrap UCL | 0.032 | 95% Bootstrap-t UCL | 0.0397 |
| 95% Hall's Bootstrap UCL | 0.0522 | 95% Percentile Bootstrap UCL | 0.0326 |
| 95% BCA Bootstrap UCL | 0.0361 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.036 | 95% Chebyshev(Mean, Sd) UCL | 0.0399 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.0454 | 99% Chebyshev(Mean, Sd) UCL | 0.0562 |

Suggested UCL to Use

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 0.0321 | or 95% Modified-t UCL | 0.0325 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Anthracene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 28 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.064 | Mean | 0.118 |
| Maximum | 0.33 | Median | 0.1 |
| SD | 0.0558 | Std. Error of Mean | 0.00894 |
| Coefficient of Variation | 0.474 | Skewness | 2.137 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.788 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.176 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.133 | 95% Adjusted-CLT UCL (Chen-1995) | 0.136 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.133 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.105 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.143 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.295 | k star (bias corrected MLE) | 5.828 |
| Theta hat (MLE) | 0.0187 | Theta star (bias corrected MLE) | 0.0202 |
| nu hat (MLE) | 491 | nu star (bias corrected) | 454.6 |
| MLE Mean (bias corrected) | 0.118 | MLE Sd (bias corrected) | 0.0488 |
| | | Approximate Chi Square Value (0.05) | 406.2 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 404.4 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.132 | 95% Adjusted Gamma UCL (use when n<50) | 0.132 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -2.749 | Mean of logged Data | -2.221 |
| Maximum of Logged Data | -1.109 | SD of logged Data | 0.386 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.131 | 90% Chebyshev (MVUE) UCL | 0.139 |
| 95% Chebyshev (MVUE) UCL | 0.149 | 97.5% Chebyshev (MVUE) UCL | 0.163 |
| 99% Chebyshev (MVUE) UCL | 0.19 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.132 | 95% Jackknife UCL | 0.133 |
| 95% Standard Bootstrap UCL | 0.132 | 95% Bootstrap-t UCL | 0.139 |
| 95% Hall's Bootstrap UCL | 0.141 | 95% Percentile Bootstrap UCL | 0.133 |
| 95% BCA Bootstrap UCL | 0.138 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.145 | 95% Chebyshev(Mean, Sd) UCL | 0.157 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.174 | 99% Chebyshev(Mean, Sd) UCL | 0.207 |

**Suggested UCL to Use**

95% Student's-t UCL 0.133 or 95% Modified-t UCL 0.133
or 95% H-UCL 0.131

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_SVOCs_ID0016|Benzo(a)anthracene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 31 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.21 | Mean | 0.758 |
| Maximum | 1.6 | Median | 0.73 |
| SD | 0.302 | Std. Error of Mean | 0.0484 |
| Coefficient of Variation | 0.398 | Skewness | 0.475 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.976 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0885 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.84 | 95% Adjusted-CLT UCL (Chen-1995) | 0.842 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.841 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.361 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.112 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.871 | k star (bias corrected MLE) | 5.436 |
| Theta hat (MLE) | 0.129 | Theta star (bias corrected MLE) | 0.14 |
| nu hat (MLE) | 457.9 | nu star (bias corrected) | 424 |
| MLE Mean (bias corrected) | 0.758 | MLE Sd (bias corrected) | 0.325 |
| | | Approximate Chi Square Value (0.05) | 377.3 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 375.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.852 | 95% Adjusted Gamma UCL (use when n<50) | 0.856 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.952 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.141 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.561 | Mean of logged Data | -0.364 |
| Maximum of Logged Data | 0.47 | SD of logged Data | 0.447 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.88 | 90% Chebyshev (MVUE) UCL | 0.936 |
| 95% Chebyshev (MVUE) UCL | 1.014 | 97.5% Chebyshev (MVUE) UCL | 1.121 |
| 99% Chebyshev (MVUE) UCL | 1.332 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.838 | 95% Jackknife UCL | 0.84 |
| 95% Standard Bootstrap UCL | 0.837 | 95% Bootstrap-t UCL | 0.841 |
| 95% Hall's Bootstrap UCL | 0.848 | 95% Percentile Bootstrap UCL | 0.838 |
| 95% BCA Bootstrap UCL | 0.843 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.904 | 95% Chebyshev(Mean, Sd) UCL | 0.969 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.061 | 99% Chebyshev(Mean, Sd) UCL | 1.24 |

**Suggested UCL to Use**

95% Student's-t UCL 0.84

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Benzo(a)pyrene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 32 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.25 | Mean | 0.947 |
| Maximum | 2.2 | Median | 0.9 |
| SD | 0.395 | Std. Error of Mean | 0.0632 |
| Coefficient of Variation | 0.417 | Skewness | 1.114 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.922 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.165 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.054 | 95% Adjusted-CLT UCL (Chen-1995) | 1.063 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.056 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.626 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.112 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.981 | k star (bias corrected MLE) | 5.538 |
| Theta hat (MLE) | 0.158 | Theta star (bias corrected MLE) | 0.171 |
| nu hat (MLE) | 466.6 | nu star (bias corrected) | 432 |
| MLE Mean (bias corrected) | 0.947 | MLE Sd (bias corrected) | 0.403 |
| | | Approximate Chi Square Value (0.05) | 384.8 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 383.1 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 1.064 | 95% Adjusted Gamma UCL (use when n<50) | 1.069 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.954 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.136 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.386 | Mean of logged Data | -0.14 |
| Maximum of Logged Data | 0.788 | SD of logged Data | 0.435 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.091 | 90% Chebyshev (MVUE) UCL | 1.16 |
| 95% Chebyshev (MVUE) UCL | 1.254 | 97.5% Chebyshev (MVUE) UCL | 1.383 |
| 99% Chebyshev (MVUE) UCL | 1.639 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.051 | 95% Jackknife UCL | 1.054 |
| 95% Standard Bootstrap UCL | 1.048 | 95% Bootstrap-t UCL | 1.073 |
| 95% Hall's Bootstrap UCL | 1.079 | 95% Percentile Bootstrap UCL | 1.048 |
| 95% BCA Bootstrap UCL | 1.056 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.137 | 95% Chebyshev(Mean, Sd) UCL | 1.223 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.342 | 99% Chebyshev(Mean, Sd) UCL | 1.576 |

**Suggested UCL to Use**

95% Adjusted Gamma UCL 1.069

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Benzo(e)pyrene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 30 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.27 | Mean | 0.857 |
| Maximum | 1.9 | Median | 0.83 |
| SD | 0.331 | Std. Error of Mean | 0.053 |
| Coefficient of Variation | 0.386 | Skewness | 0.882 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.946 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.153 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.946 | 95% Adjusted-CLT UCL (Chen-1995) | 0.952 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.947 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.467 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.115 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.775 | k star (bias corrected MLE) | 6.271 |
| Theta hat (MLE) | 0.126 | Theta star (bias corrected MLE) | 0.137 |
| nu hat (MLE) | 528.5 | nu star (bias corrected) | 489.1 |
| MLE Mean (bias corrected) | 0.857 | MLE Sd (bias corrected) | 0.342 |
| | | Approximate Chi Square Value (0.05) | 438.9 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 437 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.955 | 95% Adjusted Gamma UCL (use when n<50) | 0.959 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.958 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.309 | Mean of logged Data | -0.23 |
| Maximum of Logged Data | 0.642 | SD of logged Data | 0.408 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.975 | 90% Chebyshev (MVUE) UCL | 1.035 |
| 95% Chebyshev (MVUE) UCL | 1.114 | 97.5% Chebyshev (MVUE) UCL | 1.223 |
| 99% Chebyshev (MVUE) UCL | 1.438 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.944 | 95% Jackknife UCL | 0.946 |
| 95% Standard Bootstrap UCL | 0.943 | 95% Bootstrap-t UCL | 0.956 |
| 95% Hall's Bootstrap UCL | 0.958 | 95% Percentile Bootstrap UCL | 0.944 |
| 95% BCA Bootstrap UCL | 0.945 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.015 | 95% Chebyshev(Mean, Sd) UCL | 1.087 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.187 | 99% Chebyshev(Mean, Sd) UCL | 1.383 |

**Suggested UCL to Use**

95% Student's-t UCL 0.946

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Benzo(g,h,i)perylene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 30 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.25 | Mean | 0.863 |
| Maximum | 1.7 | Median | 0.83 |
| SD | 0.321 | Std. Error of Mean | 0.0513 |
| Coefficient of Variation | 0.372 | Skewness | 0.303 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.95 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.127 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.949 | 95% Adjusted-CLT UCL (Chen-1995) | 0.95 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.95 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.156 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.162 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.352 | k star (bias corrected MLE) | 5.88 |
| Theta hat (MLE) | 0.136 | Theta star (bias corrected MLE) | 0.147 |
| nu hat (MLE) | 495.4 | nu star (bias corrected) | 458.7 |
| MLE Mean (bias corrected) | 0.863 | MLE Sd (bias corrected) | 0.356 |
| | | Approximate Chi Square Value (0.05) | 410 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 408.2 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.965 | 95% Adjusted Gamma UCL (use when n<50) | 0.969 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.894 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.192 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.386 | Mean of logged Data | -0.228 |
| Maximum of Logged Data | 0.531 | SD of logged Data | 0.436 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.999 | 90% Chebyshev (MVUE) UCL | 1.063 |
| 95% Chebyshev (MVUE) UCL | 1.149 | 97.5% Chebyshev (MVUE) UCL | 1.268 |
| 99% Chebyshev (MVUE) UCL | 1.502 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.947 | 95% Jackknife UCL | 0.949 |
| 95% Standard Bootstrap UCL | 0.947 | 95% Bootstrap-t UCL | 0.956 |
| 95% Hall's Bootstrap UCL | 0.958 | 95% Percentile Bootstrap UCL | 0.948 |
| 95% BCA Bootstrap UCL | 0.952 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.017 | 95% Chebyshev(Mean, Sd) UCL | 1.087 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.183 | 99% Chebyshev(Mean, Sd) UCL | 1.374 |

**Suggested UCL to Use**

95% Student's-t UCL 0.949

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Benzo(k)fluoranthene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 31 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.21 | Mean | 0.685 |
| Maximum | 1.5 | Median | 0.64 |
| SD | 0.291 | Std. Error of Mean | 0.0465 |
| Coefficient of Variation | 0.424 | Skewness | 0.904 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.927 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.122 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.764 | 95% Adjusted-CLT UCL (Chen-1995) | 0.769 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.765 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.62 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.158 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Data Not Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.575 | k star (bias corrected MLE) | 5.163 |
| Theta hat (MLE) | 0.123 | Theta star (bias corrected MLE) | 0.133 |
| nu hat (MLE) | 434.9 | nu star (bias corrected) | 402.7 |
| MLE Mean (bias corrected) | 0.685 | MLE Sd (bias corrected) | 0.302 |
| | | Approximate Chi Square Value (0.05) | 357.2 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 355.5 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.772 | 95% Adjusted Gamma UCL (use when n<50) | 0.776 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.187 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.561 | Mean of logged Data | -0.47 |
| Maximum of Logged Data | 0.405 | SD of logged Data | 0.453 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.795 | 90% Chebyshev (MVUE) UCL | 0.847 |
| 95% Chebyshev (MVUE) UCL | 0.917 | 97.5% Chebyshev (MVUE) UCL | 1.016 |
| 99% Chebyshev (MVUE) UCL | 1.209 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.762 | 95% Jackknife UCL | 0.764 |
| 95% Standard Bootstrap UCL | 0.761 | 95% Bootstrap-t UCL | 0.774 |
| 95% Hall's Bootstrap UCL | 0.776 | 95% Percentile Bootstrap UCL | 0.764 |
| 95% BCA Bootstrap UCL | 0.762 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.825 | 95% Chebyshev(Mean, Sd) UCL | 0.888 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.976 | 99% Chebyshev(Mean, Sd) UCL | 1.148 |

**Suggested UCL to Use**

95% Student's-t UCL 0.764

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 22 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.51 | Mean | 1.381 |
| Maximum | 2.8 | Median | 1.38 |
| SD | 0.514 | Std. Error of Mean | 0.0823 |
| Coefficient of Variation | 0.372 | Skewness | 0.594 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.955 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.155 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.52 | 95% Adjusted-CLT UCL (Chen-1995) | 1.525 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.521 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.522 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.12 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 7.024 | k star (bias corrected MLE) | 6.501 |
| Theta hat (MLE) | 0.197 | Theta star (bias corrected MLE) | 0.212 |
| nu hat (MLE) | 547.9 | nu star (bias corrected) | 507.1 |
| MLE Mean (bias corrected) | 1.381 | MLE Sd (bias corrected) | 0.542 |
| | | Approximate Chi Square Value (0.05) | 455.8 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 453.9 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.536 | 95% Adjusted Gamma UCL (use when n<50) | 1.543 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.943 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.128 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.673 | Mean of logged Data | 0.25 |
| Maximum of Logged Data | 1.03 | SD of logged Data | 0.402 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.57 | 90% Chebyshev (MVUE) UCL | 1.666 |
| 95% Chebyshev (MVUE) UCL | 1.791 | 97.5% Chebyshev (MVUE) UCL | 1.965 |
| 99% Chebyshev (MVUE) UCL | 2.306 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.516 | 95% Jackknife UCL | 1.52 |
| 95% Standard Bootstrap UCL | 1.517 | 95% Bootstrap-t UCL | 1.528 |
| 95% Hall's Bootstrap UCL | 1.533 | 95% Percentile Bootstrap UCL | 1.517 |
| 95% BCA Bootstrap UCL | 1.521 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.628 | 95% Chebyshev(Mean, Sd) UCL | 1.74 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.895 | 99% Chebyshev(Mean, Sd) UCL | 2.2 |

**Suggested UCL to Use**

95% Student's-t UCL 1.52

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.051 | Mean | 0.139 |
| Maximum | 0.23 | Median | 0.14 |
| SD | 0.0464 | Std. Error of Mean | 0.00743 |
| Coefficient of Variation | 0.334 | Skewness | -0.0975 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.969 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0694 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.151 | 95% Adjusted-CLT UCL (Chen-1995) | 0.151 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.151 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.619 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.749 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.1 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.141 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 7.901 | k star (bias corrected MLE) | 7.31 |
| Theta hat (MLE) | 0.0176 | Theta star (bias corrected MLE) | 0.019 |
| nu hat (MLE) | 616.3 | nu star (bias corrected) | 570.2 |
| MLE Mean (bias corrected) | 0.139 | MLE Sd (bias corrected) | 0.0513 |
| | | Approximate Chi Square Value (0.05) | 515.8 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 513.8 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.153 | 95% Adjusted Gamma UCL (use when n<50) | 0.154 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.921 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.126 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -2.976 | Mean of logged Data | -2.039 |
| Maximum of Logged Data | -1.47 | SD of logged Data | 0.384 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.157 | 90% Chebyshev (MVUE) UCL | 0.166 |
| 95% Chebyshev (MVUE) UCL | 0.178 | 97.5% Chebyshev (MVUE) UCL | 0.195 |
| 99% Chebyshev (MVUE) UCL | 0.228 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.151 | 95% Jackknife UCL | 0.151 |
| 95% Standard Bootstrap UCL | 0.151 | 95% Bootstrap-t UCL | 0.151 |
| 95% Hall's Bootstrap UCL | 0.151 | 95% Percentile Bootstrap UCL | 0.151 |
| 95% BCA Bootstrap UCL | 0.15 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.161 | 95% Chebyshev(Mean, Sd) UCL | 0.171 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.185 | 99% Chebyshev(Mean, Sd) UCL | 0.213 |

**Suggested UCL to Use**

95% Student's-t UCL 0.151

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Surface Sediment

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**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.44 | Mean | 1.67 |
| Maximum | 3.7 | Median | 1.6 |
| SD | 0.707 | Std. Error of Mean | 0.113 |
| Coefficient of Variation | 0.423 | Skewness | 0.741 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.95 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.147 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 1.861 | 95% Adjusted-CLT UCL (Chen-1995) | 1.87 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.863 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.567 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.135 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.386 | k star (bias corrected MLE) | 4.989 |
| Theta hat (MLE) | 0.31 | Theta star (bias corrected MLE) | 0.335 |
| nu hat (MLE) | 420.1 | nu star (bias corrected) | 389.1 |
| MLE Mean (bias corrected) | 1.67 | MLE Sd (bias corrected) | 0.748 |
| | | Approximate Chi Square Value (0.05) | 344.4 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 342.8 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.887 | 95% Adjusted Gamma UCL (use when n<50) | 1.896 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.943 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.165 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.821 | Mean of logged Data | 0.417 |
| Maximum of Logged Data | 1.308 | SD of logged Data | 0.467 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.953 | 90% Chebyshev (MVUE) UCL | 2.081 |
| 95% Chebyshev (MVUE) UCL | 2.259 | 97.5% Chebyshev (MVUE) UCL | 2.506 |
| 99% Chebyshev (MVUE) UCL | 2.993 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.856 | 95% Jackknife UCL | 1.861 |
| 95% Standard Bootstrap UCL | 1.854 | 95% Bootstrap-t UCL | 1.881 |
| 95% Hall's Bootstrap UCL | 1.872 | 95% Percentile Bootstrap UCL | 1.868 |
| 95% BCA Bootstrap UCL | 1.852 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2.01 | 95% Chebyshev(Mean, Sd) UCL | 2.163 |
| 97.5% Chebyshev(Mean, Sd) UCL | 2.377 | 99% Chebyshev(Mean, Sd) UCL | 2.797 |

**Suggested UCL to Use**

95% Student's-t UCL 1.861

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 30 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.034 | Mean | 0.071 |
| Maximum | 0.18 | Median | 0.0595 |
| SD | 0.0347 | Std. Error of Mean | 0.00555 |
| Coefficient of Variation | 0.488 | Skewness | 1.597 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.832 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.155 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.0803 | 95% Adjusted-CLT UCL (Chen-1995) | 0.0816 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.0806 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.962 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.14 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.429 | k star (bias corrected MLE) | 5.028 |
| Theta hat (MLE) | 0.0131 | Theta star (bias corrected MLE) | 0.0141 |
| nu hat (MLE) | 423.4 | nu star (bias corrected) | 392.2 |
| MLE Mean (bias corrected) | 0.071 | MLE Sd (bias corrected) | 0.0317 |
| | | Approximate Chi Square Value (0.05) | 347.3 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 345.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.0802 | 95% Adjusted Gamma UCL (use when n<50) | 0.0805 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.125 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.381 | Mean of logged Data | -2.74 |
| Maximum of Logged Data | -1.715 | SD of logged Data | 0.424 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.0803 | 90% Chebyshev (MVUE) UCL | 0.0853 |
| 95% Chebyshev (MVUE) UCL | 0.0921 | 97.5% Chebyshev (MVUE) UCL | 0.101 |
| 99% Chebyshev (MVUE) UCL | 0.12 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.0801 | 95% Jackknife UCL | 0.0803 |
| 95% Standard Bootstrap UCL | 0.0799 | 95% Bootstrap-t UCL | 0.083 |
| 95% Hall's Bootstrap UCL | 0.0823 | 95% Percentile Bootstrap UCL | 0.0803 |
| 95% BCA Bootstrap UCL | 0.0819 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.0876 | 95% Chebyshev(Mean, Sd) UCL | 0.0952 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.106 | 99% Chebyshev(Mean, Sd) UCL | 0.126 |

**Suggested UCL to Use**

95% Adjusted Gamma UCL 0.0805

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 35 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.19 | Mean | 0.693 |
| Maximum | 1.5 | Median | 0.7 |
| SD | 0.265 | Std. Error of Mean | 0.0424 |
| Coefficient of Variation | 0.382 | Skewness | 0.49 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.965 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0961 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.765 | 95% Adjusted-CLT UCL (Chen-1995) | 0.767 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.765 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.802 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.137 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.221 | k star (bias corrected MLE) | 5.76 |
| Theta hat (MLE) | 0.111 | Theta star (bias corrected MLE) | 0.12 |
| nu hat (MLE) | 485.2 | nu star (bias corrected) | 449.2 |
| MLE Mean (bias corrected) | 0.693 | MLE Sd (bias corrected) | 0.289 |
| | | Approximate Chi Square Value (0.05) | 401.1 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 399.3 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.776 | 95% Adjusted Gamma UCL (use when n<50) | 0.78 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.924 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.167 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.661 | Mean of logged Data | -0.449 |
| Maximum of Logged Data | 0.405 | SD of logged Data | 0.438 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.803 | 90% Chebyshev (MVUE) UCL | 0.854 |
| 95% Chebyshev (MVUE) UCL | 0.923 | 97.5% Chebyshev (MVUE) UCL | 1.019 |
| 99% Chebyshev (MVUE) UCL | 1.208 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.763 | 95% Jackknife UCL | 0.765 |
| 95% Standard Bootstrap UCL | 0.763 | 95% Bootstrap-t UCL | 0.77 |
| 95% Hall's Bootstrap UCL | 0.774 | 95% Percentile Bootstrap UCL | 0.76 |
| 95% BCA Bootstrap UCL | 0.772 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.82 | 95% Chebyshev(Mean, Sd) UCL | 0.878 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.958 | 99% Chebyshev(Mean, Sd) UCL | 1.115 |

**Suggested UCL to Use**

95% Student's-t UCL 0.765

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Naphthalene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 32 |
| | | Number of Missing Observations | 40 |
| Number of Detects | 18 | Number of Non-Detects | 21 |
| Number of Distinct Detects | 18 | Number of Distinct Non-Detects | 17 |
| Minimum Detect | 0.04 | Minimum Non-Detect | 0.05 |
| Maximum Detect | 0.204 | Maximum Non-Detect | 0.293 |
| Variance Detects | 0.00194 | Percent Non-Detects | 53.85% |
| Mean Detects | 0.095 | SD Detects | 0.0441 |
| Median Detects | 0.0775 | CV Detects | 0.464 |
| Skewness Detects | 1.243 | Kurtosis Detects | 1.045 |
| Mean of Logged Detects | -2.444 | SD of Logged Detects | 0.431 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.874 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.897 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.206 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.202 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.08 | KM Standard Error of Mean | 0.00786 |
| KM SD | 0.04 | 95% KM (BCA) UCL | 0.0938 |
| 95% KM (t) UCL | 0.0932 | 95% KM (Percentile Bootstrap) UCL | 0.0924 |
| 95% KM (z) UCL | 0.0929 | 95% KM Bootstrap t UCL | 0.096 |
| 90% KM Chebyshev UCL | 0.104 | 95% KM Chebyshev UCL | 0.114 |
| 97.5% KM Chebyshev UCL | 0.129 | 99% KM Chebyshev UCL | 0.158 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.517 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.742 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.178 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.204 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.681 | k star (bias corrected MLE) | 4.771 |
| Theta hat (MLE) | 0.0167 | Theta star (bias corrected MLE) | 0.0199 |
| nu hat (MLE) | 204.5 | nu star (bias corrected) | 171.7 |
| Mean (detects) | 0.095 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.034 | Mean | 0.0769 |
| Maximum | 0.204 | Median | 0.072 |
| SD | 0.0365 | CV | 0.475 |
| k hat (MLE) | 5.662 | k star (bias corrected MLE) | 5.244 |
| Theta hat (MLE) | 0.0136 | Theta star (bias corrected MLE) | 0.0147 |
| nu hat (MLE) | 441.6 | nu star (bias corrected) | 409 |
| Adjusted Level of Significance (β) | 0.0437 | | |
| Approximate Chi Square Value (409.00, α) | 363.1 | Adjusted Chi Square Value (409.00, β) | 361.4 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0866 | 95% Gamma Adjusted UCL (use when n<50) | 0.087 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.08 | SD (KM) | 0.04 |
| Variance (KM) | 0.0016 | SE of Mean (KM) | 0.00786 |
| k hat (KM) | 4 | k star (KM) | 3.71 |
| nu hat (KM) | 312 | nu star (KM) | 289.3 |
| theta hat (KM) | 0.02 | theta star (KM) | 0.0216 |
| 80% gamma percentile (KM) | 0.111 | 90% gamma percentile (KM) | 0.136 |
| 95% gamma percentile (KM) | 0.158 | 99% gamma percentile (KM) | 0.206 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (289.34, α) | 250.9 | Adjusted Chi Square Value (289.34, β) | 249.5 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0922 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0927 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.961 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.897 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.153 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.202 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.078 | Mean in Log Scale | -2.626 |
| SD in Original Scale | 0.0351 | SD in Log Scale | 0.374 |
| 95% t UCL (assumes normality of ROS data) | 0.0875 | 95% Percentile Bootstrap UCL | 0.0875 |
| 95% BCA Bootstrap UCL | 0.0904 | 95% Bootstrap t UCL | 0.0904 |
| 95% H-UCL (Log ROS) | 0.0867 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.631 | KM Geo Mean | 0.072 |
| KM SD (logged) | 0.444 | 95% Critical H Value (KM-Log) | 1.878 |
| KM Standard Error of Mean (logged) | 0.0915 | 95% H-UCL (KM -Log) | 0.091 |
| KM SD (logged) | 0.444 | 95% Critical H Value (KM-Log) | 1.878 |
| KM Standard Error of Mean (logged) | 0.0915 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.0887 | Mean in Log Scale | -2.559 |
| SD in Original Scale | 0.0444 | SD in Log Scale | 0.553 |
| 95% t UCL (Assumes normality) | 0.101 | 95% H-Stat UCL | 0.107 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Gamma Distributed at 5% Significance Level

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 0.0927 | 95% GROS Adjusted Gamma UCL | 0.087 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Perylene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 27 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.13 | Mean | 0.315 |
| Maximum | 0.6 | Median | 0.3 |
| SD | 0.0885 | Std. Error of Mean | 0.0142 |
| Coefficient of Variation | 0.281 | Skewness | 0.77 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.952 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.122 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.339 | 95% Adjusted-CLT UCL (Chen-1995) | 0.34 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.339 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.483 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.748 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.123 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.141 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 13 | k star (bias corrected MLE) | 12.01 |
| Theta hat (MLE) | 0.0242 | Theta star (bias corrected MLE) | 0.0262 |
| nu hat (MLE) | 1014 | nu star (bias corrected) | 937.1 |
| MLE Mean (bias corrected) | 0.315 | MLE Sd (bias corrected) | 0.0908 |
| | | Approximate Chi Square Value (0.05) | 867 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 864.4 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.34 | 95% Adjusted Gamma UCL (use when n<50) | 0.341 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.956 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.133 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -2.04 | Mean of logged Data | -1.195 |
| Maximum of Logged Data | -0.511 | SD of logged Data | 0.288 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.343 | 90% Chebyshev (MVUE) UCL | 0.36 |
| 95% Chebyshev (MVUE) UCL | 0.38 | 97.5% Chebyshev (MVUE) UCL | 0.408 |
| 99% Chebyshev (MVUE) UCL | 0.462 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.338 | 95% Jackknife UCL | 0.339 |
| 95% Standard Bootstrap UCL | 0.338 | 95% Bootstrap-t UCL | 0.34 |
| 95% Hall's Bootstrap UCL | 0.342 | 95% Percentile Bootstrap UCL | 0.338 |
| 95% BCA Bootstrap UCL | 0.339 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.357 | 95% Chebyshev(Mean, Sd) UCL | 0.377 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.403 | 99% Chebyshev(Mean, Sd) UCL | 0.456 |

**Suggested UCL to Use**

95% Student's-t UCL 0.339

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Phenanthrene

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 34 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.31 | Mean | 0.724 |
| Maximum | 1.87 | Median | 0.63 |
| SD | 0.306 | Std. Error of Mean | 0.0491 |
| Coefficient of Variation | 0.423 | Skewness | 1.609 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.885 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.134 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.806 | 95% Adjusted-CLT UCL (Chen-1995) | 0.818 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.809 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.372 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.102 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.819 | k star (bias corrected MLE) | 6.312 |
| Theta hat (MLE) | 0.106 | Theta star (bias corrected MLE) | 0.115 |
| nu hat (MLE) | 531.9 | nu star (bias corrected) | 492.3 |
| MLE Mean (bias corrected) | 0.724 | MLE Sd (bias corrected) | 0.288 |
| | | Approximate Chi Square Value (0.05) | 441.9 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 440 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.806 | 95% Adjusted Gamma UCL (use when n<50) | 0.81 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.987 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0784 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.171 | Mean of logged Data | -0.398 |
| Maximum of Logged Data | 0.626 | SD of logged Data | 0.385 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.811 | 90% Chebyshev (MVUE) UCL | 0.859 |
| 95% Chebyshev (MVUE) UCL | 0.921 | 97.5% Chebyshev (MVUE) UCL | 1.007 |
| 99% Chebyshev (MVUE) UCL | 1.177 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.804 | 95% Jackknife UCL | 0.806 |
| 95% Standard Bootstrap UCL | 0.804 | 95% Bootstrap-t UCL | 0.824 |
| 95% Hall's Bootstrap UCL | 0.829 | 95% Percentile Bootstrap UCL | 0.806 |
| 95% BCA Bootstrap UCL | 0.819 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.871 | 95% Chebyshev(Mean, Sd) UCL | 0.938 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.03 | 99% Chebyshev(Mean, Sd) UCL | 1.212 |

**Suggested UCL to Use**

95% Student's-t UCL 0.806

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_SVOCs_ID0016|Pyrene

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 39 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 40 |
| Minimum | 0.54 | Mean | 1.509 |
| Maximum | 3.2 | Median | 1.4 |
| SD | 0.614 | Std. Error of Mean | 0.0984 |
| Coefficient of Variation | 0.407 | Skewness | 0.917 |

| Normal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.928 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.159 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

| Assuming Normal Distribution | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.675 | 95% Adjusted-CLT UCL (Chen-1995) | 1.687 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.678 |

| Gamma GOF Test | | |
|---|---|---|
| A-D Test Statistic | 0.5 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.13 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.142 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 6.418 | k star (bias corrected MLE) | 5.941 |
| Theta hat (MLE) | 0.235 | Theta star (bias corrected MLE) | 0.254 |
| nu hat (MLE) | 500.6 | nu star (bias corrected) | 463.4 |
| MLE Mean (bias corrected) | 1.509 | MLE Sd (bias corrected) | 0.619 |
| | | Approximate Chi Square Value (0.05) | 414.5 |
| Adjusted Level of Significance | 0.0437 | Adjusted Chi Square Value | 412.7 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 1.688 | 95% Adjusted Gamma UCL (use when n<50) | 1.695 |

| Lognormal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.153 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Data Not Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.616 | Mean of logged Data | 0.332 |
| Maximum of Logged Data | 1.163 | SD of logged Data | 0.412 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 1.717 | 90% Chebyshev (MVUE) UCL | 1.822 |
| 95% Chebyshev (MVUE) UCL | 1.963 | 97.5% Chebyshev (MVUE) UCL | 2.157 |
| 99% Chebyshev (MVUE) UCL | 2.539 | | |

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.671 | 95% Jackknife UCL | 1.675 |
| 95% Standard Bootstrap UCL | 1.669 | 95% Bootstrap-t UCL | 1.694 |
| 95% Hall's Bootstrap UCL | 1.696 | 95% Percentile Bootstrap UCL | 1.664 |
| 95% BCA Bootstrap UCL | 1.69 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.804 | 95% Chebyshev(Mean, Sd) UCL | 1.938 |
| 97.5% Chebyshev(Mean, Sd) UCL | 2.124 | 99% Chebyshev(Mean, Sd) UCL | 2.488 |

**Suggested UCL to Use**

95% Adjusted Gamma UCL 1.695

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|2,3,7,8-Tetrachlorodibenzofuran

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 40 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 40 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 39 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 1.2700E-7 | Minimum Non-Detect | 1.1800E-8 |
| Maximum Detect | 5.6700E-5 | Maximum Non-Detect | 1.1800E-8 |
| Variance Detects | 1.133E-10 | Percent Non-Detects | 2.439% |
| Mean Detects | 5.3924E-6 | SD Detects | 1.0646E-5 |
| Median Detects | 1.9800E-6 | CV Detects | N/A |
| Skewness Detects | 3.747 | Kurtosis Detects | 15.09 |
| Mean of Logged Detects | -13.04 | SD of Logged Detects | 1.267 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.485 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.94 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.31 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.139 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 5.26E-06 | KM Standard Error of Mean | 1.6474E-6 |
| KM SD | 1.0416E-5 | 95% KM (BCA) UCL | 8.3838E-6 |
| 95% KM (t) UCL | 8.0351E-6 | 95% KM (Percentile Bootstrap) UCL | 8.3730E-6 |
| 95% KM (z) UCL | 7.9709E-6 | 95% KM Bootstrap t UCL | 1.1649E-5 |
| 90% KM Chebyshev UCL | 1.0203E-5 | 95% KM Chebyshev UCL | 1.2442E-5 |
| 97.5% KM Chebyshev UCL | 1.5549E-5 | 99% KM Chebyshev UCL | 2.1653E-5 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 2.148 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.797 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.187 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.146 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.669 | k star (bias corrected MLE) | 0.635 |
| Theta hat (MLE) | 8.0604E-6 | Theta star (bias corrected MLE) | 8.4854E-6 |
| nu hat (MLE) | 53.52 | nu star (bias corrected) | 50.84 |
| Mean (detects) | 5.3924E-6 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.2700E-7 | Mean | 2.4916E-4 |
| Maximum | 0.01 | Median | 2.0000E-6 |
| SD | 0.00156 | CV | 6.265 |
| k hat (MLE) | 0.167 | k star (bias corrected MLE) | 0.171 |
| Theta hat (MLE) | 0.00149 | Theta star (bias corrected MLE) | 0.00146 |
| nu hat (MLE) | 13.68 | nu star (bias corrected) | 14.01 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (14.01, α) | 6.578 | Adjusted Chi Square Value (14.01, β) | 6.391 |
| 95% Gamma Approximate UCL (use when n>=50) | 5.3067E-4 | 95% Gamma Adjusted UCL (use when n<50) | 5.4614E-4 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 5.2611E-6 | SD (KM) | 1.0416E-5 |
| Variance (KM) | 1.085E-10 | SE of Mean (KM) | 1.6474E-6 |
| k hat (KM) | 0.255 | k star (KM) | 0.253 |
| nu hat (KM) | 20.92 | nu star (KM) | 20.72 |
| theta hat (KM) | 2.0621E-5 | theta star (KM) | 2.0817E-5 |
| 80% gamma percentile (KM) | 7.6702E-6 | 90% gamma percentile (KM) | 1.5779E-5 |
| 95% gamma percentile (KM) | 2.5384E-5 | 99% gamma percentile (KM) | 5.0913E-5 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (20.72, α) | 11.39 | Adjusted Chi Square Value (20.72, β) | 11.13 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 9.5755E-6 | 95% Gamma Adjusted KM-UCL (use when n<50) | 9.7935E-6 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.979 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.94 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0937 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.139 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 5.2629E-6 | Mean in Log Scale | -13.12 |
| SD in Original Scale | 1.0544E-5 | SD in Log Scale | 1.349 |
| 95% t UCL (assumes normality of ROS data) | 8.0358E-6 | 95% Percentile Bootstrap UCL | 8.0413E-6 |
| 95% BCA Bootstrap UCL | 9.3189E-6 | 95% Bootstrap t UCL | 1.1027E-5 |
| 95% H-UCL (Log ROS) | 8.9916E-6 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -13.17 | KM Geo Mean | 1.9129E-6 |
| KM SD (logged) | 1.474 | 95% Critical H Value (KM-Log) | 2.923 |
| KM Standard Error of Mean (logged) | 0.233 | 95% H-UCL (KM -Log) | 1.1212E-5 |
| KM SD (logged) | 1.474 | 95% Critical H Value (KM-Log) | 2.923 |
| KM Standard Error of Mean (logged) | 0.233 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 5.2610E-6 | Mean in Log Scale | -13.18 |
| SD in Original Scale | 1.0545E-5 | SD in Log Scale | 1.554 |
| 95% t UCL (Assumes normality) | 8.0341E-6 | 95% H-Stat UCL | 1.3250E-5 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Lognormal Distributed at 5% Significance Level**

**Suggested UCL to Use**

KM H-UCL 1.12E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,7,8-Pentachlorodibenzo-p-dioxin

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 39 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 39 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 4.2600E-8 | Minimum Non-Detect | 3.6000E-7 |
| Maximum Detect | 2.7700E-4 | Maximum Non-Detect | 6.3000E-6 |
| Variance Detects | 2.3828E-9 | Percent Non-Detects | 4.878% |
| Mean Detects | 1.6733E-5 | SD Detects | 4.8814E-5 |
| Median Detects | 2.4000E-6 | CV Detects | N/A |
| Skewness Detects | 4.578 | Kurtosis Detects | 22.62 |
| Mean of Logged Detects | -12.71 | SD of Logged Detects | 1.737 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.37 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.384 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 1.60E-05 | KM Standard Error of Mean | 7.4549E-6 |
| KM SD | 4.7118E-5 | 95% KM (BCA) UCL | 3.0279E-5 |
| 95% KM (t) UCL | 2.8518E-5 | 95% KM (Percentile Bootstrap) UCL | 2.9278E-5 |
| 95% KM (z) UCL | 2.8227E-5 | 95% KM Bootstrap t UCL | 7.7211E-5 |
| 90% KM Chebyshev UCL | 3.8329E-5 | 95% KM Chebyshev UCL | 4.8460E-5 |
| 97.5% KM Chebyshev UCL | 6.2520E-5 | 99% KM Chebyshev UCL | 9.0140E-5 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 3.107 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.838 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.21 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.152 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.386 | k star (bias corrected MLE) | 0.373 |
| Theta hat (MLE) | 4.3340E-5 | Theta star (bias corrected MLE) | 4.4803E-5 |
| nu hat (MLE) | 30.12 | nu star (bias corrected) | 29.13 |
| Mean (detects) | 1.6733E-5 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 4.2600E-8 | Mean | 5.0372E-4 |
| Maximum | 0.01 | Median | 2.5000E-6 |
| SD | 0.00218 | CV | 4.323 |
| k hat (MLE) | 0.161 | k star (bias corrected MLE) | 0.166 |
| Theta hat (MLE) | 0.00313 | Theta star (bias corrected MLE) | 0.00304 |
| nu hat (MLE) | 13.2 | nu star (bias corrected) | 13.57 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (13.57, α) | 6.279 | Adjusted Chi Square Value (13.57, β) | 6.098 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00109 | 95% Gamma Adjusted UCL (use when n<50) | 0.00112 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 1.5965E-5 | SD (KM) | 4.7118E-5 |
| Variance (KM) | 2.2201E-9 | SE of Mean (KM) | 7.4549E-6 |
| k hat (KM) | 0.115 | k star (KM) | 0.123 |
| nu hat (KM) | 9.414 | nu star (KM) | 10.06 |
| theta hat (KM) | 1.3906E-4 | theta star (KM) | 1.3015E-4 |
| 80% gamma percentile (KM) | 1.4348E-5 | 90% gamma percentile (KM) | 4.5499E-5 |
| 95% gamma percentile (KM) | 9.0840E-5 | 99% gamma percentile (KM) | 2.2848E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (10.06, α) | 3.978 | Adjusted Chi Square Value (10.06, β) | 3.839 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 4.0364E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 4.1828E-5 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.973 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0889 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.5953E-5 | Mean in Log Scale | -12.81 |
| SD in Original Scale | 4.7706E-5 | SD in Log Scale | 1.776 |
| 95% t UCL (assumes normality of ROS data) | 2.8498E-5 | 95% Percentile Bootstrap UCL | 2.9516E-5 |
| 95% BCA Bootstrap UCL | 3.6886E-5 | 95% Bootstrap t UCL | 6.1822E-5 |
| 95% H-UCL (Log ROS) | 3.3604E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -12.82 | KM Geo Mean | 2.7192E-6 |
| KM SD (logged) | 1.767 | 95% Critical H Value (KM-Log) | 3.315 |
| KM Standard Error of Mean (logged) | 0.283 | 95% H-UCL (KM -Log) | 3.2715E-5 |
| KM SD (logged) | 1.767 | 95% Critical H Value (KM-Log) | 3.315 |
| KM Standard Error of Mean (logged) | 0.283 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.5998E-5 | Mean in Log Scale | -12.78 |
| SD in Original Scale | 4.7693E-5 | SD in Log Scale | 1.75 |
| 95% t UCL (Assumes normality) | 2.8540E-5 | 95% H-Stat UCL | 3.2355E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 4.85E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,6,7,8-Hexachlorodibenzofuran

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 36 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 36 | Number of Distinct Non-Detects | 5 |
| Minimum Detect | 1.0500E-7 | Minimum Non-Detect | 2.5000E-8 |
| Maximum Detect | 2.7200E-4 | Maximum Non-Detect | 7.6000E-6 |
| Variance Detects | 2.5079E-9 | Percent Non-Detects | 12.2% |
| Mean Detects | 2.0023E-5 | SD Detects | 5.0079E-5 |
| Median Detects | 4.3650E-6 | CV Detects | N/A |
| Skewness Detects | 4.212 | Kurtosis Detects | 19.37 |
| Mean of Logged Detects | -12.23 | SD of Logged Detects | 1.629 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.422 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.935 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.355 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.145 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 1.76E-05 | KM Standard Error of Mean | 7.3984E-6 |
| KM SD | 4.6709E-5 | 95% KM (BCA) UCL | 3.1029E-5 |
| 95% KM (t) UCL | 3.0104E-5 | 95% KM (Percentile Bootstrap) UCL | 3.1014E-5 |
| 95% KM (z) UCL | 2.9816E-5 | 95% KM Bootstrap t UCL | 5.3548E-5 |
| 90% KM Chebyshev UCL | 3.9841E-5 | 95% KM Chebyshev UCL | 4.9895E-5 |
| 97.5% KM Chebyshev UCL | 6.3849E-5 | 99% KM Chebyshev UCL | 9.1259E-5 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 2.282 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.822 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.202 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.156 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.455 | k star (bias corrected MLE) | 0.436 |
| Theta hat (MLE) | 4.3966E-5 | Theta star (bias corrected MLE) | 4.5926E-5 |
| nu hat (MLE) | 32.79 | nu star (bias corrected) | 31.39 |
| Mean (detects) | 2.0023E-5 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.0500E-7 | Mean | 0.00124 |
| Maximum | 0.01 | Median | 5.3700E-6 |
| SD | 0.00331 | CV | 2.673 |
| k hat (MLE) | 0.165 | k star (bias corrected MLE) | 0.169 |
| Theta hat (MLE) | 0.00752 | Theta star (bias corrected MLE) | 0.00733 |
| nu hat (MLE) | 13.49 | nu star (bias corrected) | 13.84 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (13.84, α) | 6.46 | Adjusted Chi Square Value (13.84, β) | 6.275 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00265 | 95% Gamma Adjusted UCL (use when n<50) | 0.00273 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 1.7646E-5 | SD (KM) | 4.6709E-5 |
| Variance (KM) | 2.1817E-9 | SE of Mean (KM) | 7.3984E-6 |
| k hat (KM) | 0.143 | k star (KM) | 0.149 |
| nu hat (KM) | 11.7 | nu star (KM) | 12.18 |
| theta hat (KM) | 1.2364E-4 | theta star (KM) | 1.1880E-4 |
| 80% gamma percentile (KM) | 1.9055E-5 | 90% gamma percentile (KM) | 5.2255E-5 |
| 95% gamma percentile (KM) | 9.7307E-5 | 99% gamma percentile (KM) | 2.2831E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (12.18, α) | 5.346 | Adjusted Chi Square Value (12.18, β) | 5.181 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 4.0205E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 4.1488E-5 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.982 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.935 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0855 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.145 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.7634E-5 | Mean in Log Scale | -12.61 |
| SD in Original Scale | 4.7292E-5 | SD in Log Scale | 1.866 |
| 95% t UCL (assumes normality of ROS data) | 3.0070E-5 | 95% Percentile Bootstrap UCL | 3.0326E-5 |
| 95% BCA Bootstrap UCL | 3.8227E-5 | 95% Bootstrap t UCL | 5.7996E-5 |
| 95% H-UCL (Log ROS) | 5.2756E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -12.76 | KM Geo Mean | 2.8663E-6 |
| KM SD (logged) | 2.156 | 95% Critical H Value (KM-Log) | 3.863 |
| KM Standard Error of Mean (logged) | 0.346 | 95% H-UCL (KM -Log) | 1.0940E-4 |
| KM SD (logged) | 2.156 | 95% Critical H Value (KM-Log) | 3.863 |
| KM Standard Error of Mean (logged) | 0.346 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.7681E-5 | Mean in Log Scale | -12.73 |
| SD in Original Scale | 4.7277E-5 | SD in Log Scale | 2.191 |
| 95% t UCL (Assumes normality) | 3.0114E-5 | 95% H-Stat UCL | 1.2591E-4 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 4.99E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 44 |
| Minimum | 2.6500E-7 | Mean | 3.3186E-5 |
| Maximum | 5.4800E-4 | Median | 5.9000E-6 |
| SD | 9.7139E-5 | Std. Error of Mean | 1.5170E-5 |
| Coefficient of Variation | N/A | Skewness | 4.527 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.36 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.404 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 5.8730E-5 | 95% Adjusted-CLT UCL (Chen-1995) | 6.9599E-5 |
| | | 95% Modified-t UCL (Johnson-1978) | 6.0518E-5 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 3.814 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.831 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.247 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.147 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.422 | k star (bias corrected MLE) | 0.407 |
| Theta hat (MLE) | 7.8635E-5 | Theta star (bias corrected MLE) | 8.1457E-5 |
| nu hat (MLE) | 34.61 | nu star (bias corrected) | 33.41 |
| MLE Mean (bias corrected) | 3.3186E-5 | MLE Sd (bias corrected) | 5.1992E-5 |
| | | Approximate Chi Square Value (0.05) | 21.19 |
| Adjusted Level of Significance | 0.0441 | Adjusted Chi Square Value | 20.83 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 5.2316E-5 | 95% Adjusted Gamma UCL (use when n<50) | 5.3211E-5 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.962 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -15.14 | Mean of logged Data | -11.86 |
| Maximum of Logged Data | -7.509 | SD of logged Data | 1.553 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 4.9601E-5 | 90% Chebyshev (MVUE) UCL | 4.3534E-5 |
| 95% Chebyshev (MVUE) UCL | 5.3186E-5 | 97.5% Chebyshev (MVUE) UCL | 6.6582E-5 |
| 99% Chebyshev (MVUE) UCL | 9.2897E-5 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 5.8139E-5 | 95% Jackknife UCL | 5.8730E-5 |
| 95% Standard Bootstrap UCL | 5.8178E-5 | 95% Bootstrap-t UCL | 1.4944E-4 |
| 95% Hall's Bootstrap UCL | 1.4346E-4 | 95% Percentile Bootstrap UCL | 6.2141E-5 |
| 95% BCA Bootstrap UCL | 7.4894E-5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 7.8697E-5 | 95% Chebyshev(Mean, Sd) UCL | 9.9312E-5 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.2793E-4 | 99% Chebyshev(Mean, Sd) UCL | 1.8413E-4 |

**Suggested UCL to Use**

95% Chebyshev (Mean, Sd) UCL 9.93E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,4,7,8-Hexachlorodibenzofuran

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 39 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 39 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 9.0200E-8 | Minimum Non-Detect | 6.9000E-7 |
| Maximum Detect | 4.7000E-4 | Maximum Non-Detect | 1.3000E-5 |
| Variance Detects | 7.4420E-9 | Percent Non-Detects | 4.878% |
| Mean Detects | 3.0881E-5 | SD Detects | 8.6267E-5 |
| Median Detects | 3.6000E-6 | CV Detects | N/A |
| Skewness Detects | 4.1 | Kurtosis Detects | 18.52 |
| Mean of Logged Detects | -12.3 | SD of Logged Detects | 1.823 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.402 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.428 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 2.95E-05 | KM Standard Error of Mean | 1.3177E-5 |
| KM SD | 8.3285E-5 | 95% KM (BCA) UCL | 5.3074E-5 |
| 95% KM (t) UCL | 5.1665E-5 | 95% KM (Percentile Bootstrap) UCL | 5.3230E-5 |
| 95% KM (z) UCL | 5.1151E-5 | 95% KM Bootstrap t UCL | 8.1715E-5 |
| 90% KM Chebyshev UCL | 6.9009E-5 | 95% KM Chebyshev UCL | 8.6915E-5 |
| 97.5% KM Chebyshev UCL | 1.1177E-4 | 99% KM Chebyshev UCL | 1.6059E-4 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 3.807 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.846 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.28 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.152 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.351 | k star (bias corrected MLE) | 0.341 |
| Theta hat (MLE) | 8.7954E-5 | Theta star (bias corrected MLE) | 9.0509E-5 |
| nu hat (MLE) | 27.39 | nu star (bias corrected) | 26.61 |
| Mean (detects) | 3.0881E-5 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 9.0200E-8 | Mean | 5.1718E-4 |
| Maximum | 0.01 | Median | 4.1400E-6 |
| SD | 0.00218 | CV | 4.207 |
| k hat (MLE) | 0.173 | k star (bias corrected MLE) | 0.176 |
| Theta hat (MLE) | 0.00299 | Theta star (bias corrected MLE) | 0.00293 |
| nu hat (MLE) | 14.16 | nu star (bias corrected) | 14.46 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (14.46, α) | 6.889 | Adjusted Chi Square Value (14.46, β) | 6.698 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00109 | 95% Gamma Adjusted UCL (use when n<50) | 0.00112 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 2.9477E-5 | SD (KM) | 8.3285E-5 |
| Variance (KM) | 6.9364E-9 | SE of Mean (KM) | 1.3177E-5 |
| k hat (KM) | 0.125 | k star (KM) | 0.132 |
| nu hat (KM) | 10.27 | nu star (KM) | 10.85 |
| theta hat (KM) | 2.3532E-4 | theta star (KM) | 2.2270E-4 |
| 80% gamma percentile (KM) | 2.8670E-5 | 90% gamma percentile (KM) | 8.5526E-5 |
| 95% gamma percentile (KM) | 1.6587E-4 | 99% gamma percentile (KM) | 4.0541E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (10.85, α) | 4.482 | Adjusted Chi Square Value (10.85, β) | 4.333 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 7.1381E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 7.3841E-5 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.957 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.117 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 2.9449E-5 | Mean in Log Scale | -12.38 |
| SD in Original Scale | 8.4327E-5 | SD in Log Scale | 1.832 |
| 95% t UCL (assumes normality of ROS data) | 5.1625E-5 | 95% Percentile Bootstrap UCL | 5.4016E-5 |
| 95% BCA Bootstrap UCL | 6.3884E-5 | 95% Bootstrap t UCL | 8.0578E-5 |
| 95% H-UCL (Log ROS) | 6.0262E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -12.38 | KM Geo Mean | 4.1944E-6 |
| KM SD (logged) | 1.818 | 95% Critical H Value (KM-Log) | 3.385 |
| KM Standard Error of Mean (logged) | 0.29 | 95% H-UCL (KM -Log) | 5.7936E-5 |
| KM SD (logged) | 1.818 | 95% Critical H Value (KM-Log) | 3.385 |
| KM Standard Error of Mean (logged) | 0.29 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 2.9542E-5 | Mean in Log Scale | -12.35 |
| SD in Original Scale | 8.4299E-5 | SD in Log Scale | 1.824 |
| 95% t UCL (Assumes normality) | 5.1710E-5 | 95% H-Stat UCL | 6.0505E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 8.69E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_DioxinFurans|1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 39 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 39 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 1.5800E-7 | Minimum Non-Detect | 4.3000E-7 |
| Maximum Detect | 2.8900E-4 | Maximum Non-Detect | 7.6000E-6 |
| Variance Detects | 2.7769E-9 | Percent Non-Detects | 4.878% |
| Mean Detects | 1.8402E-5 | SD Detects | 5.2696E-5 |
| Median Detects | 2.5700E-6 | CV Detects | N/A |
| Skewness Detects | 4.323 | Kurtosis Detects | 19.86 |
| Mean of Logged Detects | -12.57 | SD of Logged Detects | 1.635 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.378 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.399 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 1.76E-05 | KM Standard Error of Mean | 8.0482E-6 |
| KM SD | 5.0868E-5 | 95% KM (BCA) UCL | 3.2698E-5 |
| 95% KM (t) UCL | 3.1113E-5 | 95% KM (Percentile Bootstrap) UCL | 3.2299E-5 |
| 95% KM (z) UCL | 3.0799E-5 | 95% KM Bootstrap t UCL | 6.5425E-5 |
| 90% KM Chebyshev UCL | 4.1706E-5 | 95% KM Chebyshev UCL | 5.2642E-5 |
| 97.5% KM Chebyshev UCL | 6.7822E-5 | 99% KM Chebyshev UCL | 9.7640E-5 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 3.632 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.836 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.254 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.152 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.396 | k star (bias corrected MLE) | 0.383 |
| Theta hat (MLE) | 4.6485E-5 | Theta star (bias corrected MLE) | 4.8108E-5 |
| nu hat (MLE) | 30.88 | nu star (bias corrected) | 29.84 |
| Mean (detects) | 1.8402E-5 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.5800E-7 | Mean | 5.0531E-4 |
| Maximum | 0.01 | Median | 2.7000E-6 |
| SD | 0.00218 | CV | 4.309 |
| k hat (MLE) | 0.165 | k star (bias corrected MLE) | 0.169 |
| Theta hat (MLE) | 0.00306 | Theta star (bias corrected MLE) | 0.00298 |
| nu hat (MLE) | 13.54 | nu star (bias corrected) | 13.88 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (13.88, α) | 6.491 | Adjusted Chi Square Value (13.88, β) | 6.306 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00108 | 95% Gamma Adjusted UCL (use when n<50) | 0.00111 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 1.7561E-5 | SD (KM) | 5.0868E-5 |
| Variance (KM) | 2.5876E-9 | SE of Mean (KM) | 8.0482E-6 |
| k hat (KM) | 0.119 | k star (KM) | 0.127 |
| nu hat (KM) | 9.773 | nu star (KM) | 10.39 |
| theta hat (KM) | 1.4735E-4 | theta star (KM) | 1.3858E-4 |
| 80% gamma percentile (KM) | 1.6342E-5 | 90% gamma percentile (KM) | 5.0456E-5 |
| 95% gamma percentile (KM) | 9.9471E-5 | 99% gamma percentile (KM) | 2.4710E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (10.39, α) | 4.188 | Adjusted Chi Square Value (10.39, β) | 4.044 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 4.3575E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 4.5122E-5 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.952 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.133 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.7551E-5 | Mean in Log Scale | -12.66 |
| SD in Original Scale | 5.1503E-5 | SD in Log Scale | 1.67 |
| 95% t UCL (assumes normality of ROS data) | 3.1095E-5 | 95% Percentile Bootstrap UCL | 3.2465E-5 |
| 95% BCA Bootstrap UCL | 4.0187E-5 | 95% Bootstrap t UCL | 6.5933E-5 |
| 95% H-UCL (Log ROS) | 2.9615E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -12.65 | KM Geo Mean | 3.1955E-6 |
| KM SD (logged) | 1.638 | 95% Critical H Value (KM-Log) | 3.139 |
| KM Standard Error of Mean (logged) | 0.261 | 95% H-UCL (KM -Log) | 2.7553E-5 |
| KM SD (logged) | 1.638 | 95% Critical H Value (KM-Log) | 3.139 |
| KM Standard Error of Mean (logged) | 0.261 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.7603E-5 | Mean in Log Scale | -12.63 |
| SD in Original Scale | 5.1488E-5 | SD in Log Scale | 1.652 |
| 95% t UCL (Assumes normality) | 3.1142E-5 | 95% H-Stat UCL | 2.9078E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 5.26E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,4,6,7,8-Heptachlorodibenzofuran

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 40 |
| | | Number of Missing Observations | 44 |
| Minimum | 2.3700E-7 | Mean | 7.7403E-5 |
| Maximum | 0.00108 | Median | 2.3300E-5 |
| SD | 1.8703E-4 | Std. Error of Mean | 2.9209E-5 |
| Coefficient of Variation | N/A | Skewness | 4.497 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.406 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.376 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.2659E-4 | 95% Adjusted-CLT UCL (Chen-1995) | 1.4737E-4 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.3000E-4 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 2.767 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.808 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.228 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.145 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.554 | k star (bias corrected MLE) | 0.53 |
| Theta hat (MLE) | 1.3967E-4 | Theta star (bias corrected MLE) | 1.4607E-4 |
| nu hat (MLE) | 45.44 | nu star (bias corrected) | 43.45 |
| MLE Mean (bias corrected) | 7.7403E-5 | MLE Sd (bias corrected) | 1.0633E-4 |
| | | Approximate Chi Square Value (0.05) | 29.34 |
| Adjusted Level of Significance | 0.0441 | Adjusted Chi Square Value | 28.91 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.1465E-4 | 95% Adjusted Gamma UCL (use when n<50) | 1.1633E-4 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.957 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.118 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -15.26 | Mean of logged Data | -10.59 |
| Maximum of Logged Data | -6.831 | SD of logged Data | 1.462 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.4264E-4 | 90% Chebyshev (MVUE) UCL | 1.3071E-4 |
| 95% Chebyshev (MVUE) UCL | 1.5852E-4 | 97.5% Chebyshev (MVUE) UCL | 1.9713E-4 |
| 99% Chebyshev (MVUE) UCL | 2.7297E-4 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.2545E-4 | 95% Jackknife UCL | 1.2659E-4 |
| 95% Standard Bootstrap UCL | 1.2525E-4 | 95% Bootstrap-t UCL | 2.3720E-4 |
| 95% Hall's Bootstrap UCL | 3.2180E-4 | 95% Percentile Bootstrap UCL | 1.2921E-4 |
| 95% BCA Bootstrap UCL | 1.5073E-4 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.6503E-4 | 95% Chebyshev(Mean, Sd) UCL | 2.05E-04 |
| 97.5% Chebyshev(Mean, Sd) UCL | 2.5981E-4 | 99% Chebyshev(Mean, Sd) UCL | 3.6803E-4 |

**Suggested UCL to Use**

95% H-UCL 1.4264E-4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_DioxinFurans|1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 44 |
| Minimum | 8.4200E-6 | Mean | 3.0433E-4 |
| Maximum | 0.0041 | Median | 1.2500E-4 |
| SD | 7.0856E-4 | Std. Error of Mean | 1.1066E-4 |
| Coefficient of Variation | 2.328 | Skewness | 4.554 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.392 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.392 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 4.9066E-4 | 95% Adjusted-CLT UCL (Chen-1995) | 5.7043E-4 |
| | | 95% Modified-t UCL (Johnson-1978) | 5.0378E-4 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 3.188 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.797 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.246 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.144 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.67 | k star (bias corrected MLE) | 0.637 |
| Theta hat (MLE) | 4.5406E-4 | Theta star (bias corrected MLE) | 4.7741E-4 |
| nu hat (MLE) | 54.96 | nu star (bias corrected) | 52.27 |
| MLE Mean (bias corrected) | 3.0433E-4 | MLE Sd (bias corrected) | 3.8117E-4 |
| | | Approximate Chi Square Value (0.05) | 36.66 |
| Adjusted Level of Significance | 0.0441 | Adjusted Chi Square Value | 36.19 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 4.3387E-4 | 95% Adjusted Gamma UCL (use when n<50) | 4.3960E-4 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.955 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.124 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -11.68 | Mean of logged Data | -9.005 |
| Maximum of Logged Data | -5.497 | SD of logged Data | 1.188 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 4.0315E-4 | 90% Chebyshev (MVUE) UCL | 4.0628E-4 |
| 95% Chebyshev (MVUE) UCL | 4.8068E-4 | 97.5% Chebyshev (MVUE) UCL | 5.8396E-4 |
| 99% Chebyshev (MVUE) UCL | 7.8683E-4 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 4.8635E-4 | 95% Jackknife UCL | 4.9066E-4 |
| 95% Standard Bootstrap UCL | 4.8230E-4 | 95% Bootstrap-t UCL | 9.8643E-4 |
| 95% Hall's Bootstrap UCL | 0.00112 | 95% Percentile Bootstrap UCL | 5.1552E-4 |
| 95% BCA Bootstrap UCL | 5.9973E-4 | | |
| 90% Chebyshev(Mean, Sd) UCL | 6.3631E-4 | 95% Chebyshev(Mean, Sd) UCL | 7.87E-04 |
| 97.5% Chebyshev(Mean, Sd) UCL | 9.9539E-4 | 99% Chebyshev(Mean, Sd) UCL | 0.00141 |

**Suggested UCL to Use**

95% H-UCL 4.0315E-4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

RA18_SE_DioxinFurans|Octachlorochlorodibenzofuran

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 40 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 39 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 38 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 5.1400E-7 | Minimum Non-Detect | 1.0000E-5 |
| Maximum Detect | 0.001 | Maximum Non-Detect | 5.1000E-5 |
| Variance Detects | 2.9985E-8 | Percent Non-Detects | 4.878% |
| Mean Detects | 8.9156E-5 | SD Detects | 1.7316E-4 |
| Median Detects | 4.6000E-5 | CV Detects | N/A |
| Skewness Detects | 4.416 | Kurtosis Detects | 21.39 |
| Mean of Logged Detects | -10.09 | SD of Logged Detects | 1.254 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.443 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.349 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 8.56E-05 | KM Standard Error of Mean | 2.6503E-5 |
| KM SD | 1.6749E-4 | 95% KM (BCA) UCL | 1.3391E-4 |
| 95% KM (t) UCL | 1.3019E-4 | 95% KM (Percentile Bootstrap) UCL | 1.3326E-4 |
| 95% KM (z) UCL | 1.2915E-4 | 95% KM Bootstrap t UCL | 2.2961E-4 |
| 90% KM Chebyshev UCL | 1.6507E-4 | 95% KM Chebyshev UCL | 2.0108E-4 |
| 97.5% KM Chebyshev UCL | 2.5107E-4 | 99% KM Chebyshev UCL | 3.4926E-4 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 2.028 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.788 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.189 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.147 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.776 | k star (bias corrected MLE) | 0.734 |
| Theta hat (MLE) | 1.1485E-4 | Theta star (bias corrected MLE) | 1.2152E-4 |
| nu hat (MLE) | 60.55 | nu star (bias corrected) | 57.23 |
| Mean (detects) | 8.9156E-5 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 5.1400E-7 | Mean | 5.7261E-4 |
| Maximum | 0.01 | Median | 4.6400E-5 |
| SD | 0.00217 | CV | 3.786 |
| k hat (MLE) | 0.293 | k star (bias corrected MLE) | 0.288 |
| Theta hat (MLE) | 0.00195 | Theta star (bias corrected MLE) | 0.00199 |
| nu hat (MLE) | 24.05 | nu star (bias corrected) | 23.62 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (23.62, α) | 13.56 | Adjusted Chi Square Value (23.62, β) | 13.28 |
| 95% Gamma Approximate UCL (use when n>=50) | 9.9736E-4 | 95% Gamma Adjusted UCL (use when n<50) | 0.00102 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 8.5560E-5 | SD (KM) | 1.6749E-4 |
| Variance (KM) | 2.8054E-8 | SE of Mean (KM) | 2.6503E-5 |
| k hat (KM) | 0.261 | k star (KM) | 0.258 |
| nu hat (KM) | 21.4 | nu star (KM) | 21.16 |
| theta hat (KM) | 3.2789E-4 | theta star (KM) | 3.3149E-4 |
| 80% gamma percentile (KM) | 1.2564E-4 | 90% gamma percentile (KM) | 2.5620E-4 |
| 95% gamma percentile (KM) | 4.1020E-4 | 99% gamma percentile (KM) | 8.1836E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (21.16, α) | 11.71 | Adjusted Chi Square Value (21.16, β) | 11.46 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.5459E-4 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.5806E-4 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.933 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.125 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Approximate Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 8.5414E-5 | Mean in Log Scale | -10.16 |
| SD in Original Scale | 1.6961E-4 | SD in Log Scale | 1.273 |
| 95% t UCL (assumes normality of ROS data) | 1.3002E-4 | 95% Percentile Bootstrap UCL | 1.3196E-4 |
| 95% BCA Bootstrap UCL | 1.5475E-4 | 95% Bootstrap t UCL | 2.2749E-4 |
| 95% H-UCL (Log ROS) | 1.4830E-4 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -10.18 | KM Geo Mean | 3.8011E-5 |
| KM SD (logged) | 1.308 | 95% Critical H Value (KM-Log) | 2.711 |
| KM Standard Error of Mean (logged) | 0.212 | 95% H-UCL (KM -Log) | 1.5654E-4 |
| KM SD (logged) | 1.308 | 95% Critical H Value (KM-Log) | 2.711 |
| KM Standard Error of Mean (logged) | 0.212 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 8.5551E-5 | Mean in Log Scale | -10.16 |
| SD in Original Scale | 1.6956E-4 | SD in Log Scale | 1.268 |
| 95% t UCL (Assumes normality) | 1.3014E-4 | 95% H-Stat UCL | 1.4807E-4 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

KM H-UCL 1.57E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|Octachlorochlorodibenzo-p-dioxin

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 40 |
| | | Number of Missing Observations | 44 |
| Minimum | 3.3800E-4 | Mean | 0.00358 |
| Maximum | 0.0147 | Median | 0.00281 |
| SD | 0.00318 | Std. Error of Mean | 4.9738E-4 |
| Coefficient of Variation | 0.889 | Skewness | 1.793 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.823 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.183 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.00442 | 95% Adjusted-CLT UCL (Chen-1995) | 0.00455 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.00444 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.228 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.767 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0857 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.141 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.476 | k star (bias corrected MLE) | 1.384 |
| Theta hat (MLE) | 0.00243 | Theta star (bias corrected MLE) | 0.00259 |
| nu hat (MLE) | 121 | nu star (bias corrected) | 113.5 |
| MLE Mean (bias corrected) | 0.00358 | MLE Sd (bias corrected) | 0.00305 |
| | | Approximate Chi Square Value (0.05) | 89.89 |
| Adjusted Level of Significance | 0.0441 | Adjusted Chi Square Value | 89.13 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.00452 | 95% Adjusted Gamma UCL (use when n<50) | 0.00456 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.941 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0986 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.137 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -7.992 | Mean of logged Data | -6.007 |
| Maximum of Logged Data | -4.22 | SD of logged Data | 0.936 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.00534 | 90% Chebyshev (MVUE) UCL | 0.00565 |
| 95% Chebyshev (MVUE) UCL | 0.0065 | 97.5% Chebyshev (MVUE) UCL | 0.00769 |
| 99% Chebyshev (MVUE) UCL | 0.01 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.0044 | 95% Jackknife UCL | 0.00442 |
| 95% Standard Bootstrap UCL | 0.00437 | 95% Bootstrap-t UCL | 0.00456 |
| 95% Hall's Bootstrap UCL | 0.00463 | 95% Percentile Bootstrap UCL | 0.00449 |
| 95% BCA Bootstrap UCL | 0.00454 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.00507 | 95% Chebyshev(Mean, Sd) UCL | 0.00575 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.00669 | 99% Chebyshev(Mean, Sd) UCL | 0.00853 |

**Suggested UCL to Use**

95% Adjusted Gamma UCL 0.00456

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,7,8-PeCDF

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 38 | Number of Non-Detects | 3 |
| Number of Distinct Detects | 38 | Number of Distinct Non-Detects | 3 |
| Minimum Detect | 1.1300E-7 | Minimum Non-Detect | 1.7700E-8 |
| Maximum Detect | 1.2400E-4 | Maximum Non-Detect | 2.9000E-6 |
| Variance Detects | 5.205E-10 | Percent Non-Detects | 7.317% |
| Mean Detects | 8.8186E-6 | SD Detects | 2.2814E-5 |
| Median Detects | 1.2950E-6 | CV Detects | N/A |
| Skewness Detects | 4.125 | Kurtosis Detects | 18.57 |
| Mean of Logged Detects | -13.23 | SD of Logged Detects | 1.674 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.422 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.938 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.351 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.142 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 8.20E-06 | KM Standard Error of Mean | 3.4481E-6 |
| KM SD | 2.1786E-5 | 95% KM (BCA) UCL | 1.4886E-5 |
| 95% KM (t) UCL | 1.4002E-5 | 95% KM (Percentile Bootstrap) UCL | 1.4406E-5 |
| 95% KM (z) UCL | 1.3867E-5 | 95% KM Bootstrap t UCL | 2.2758E-5 |
| 90% KM Chebyshev UCL | 1.8540E-5 | 95% KM Chebyshev UCL | 2.3225E-5 |
| 97.5% KM Chebyshev UCL | 2.9729E-5 | 99% KM Chebyshev UCL | 4.2504E-5 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 2.833 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.833 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.224 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.153 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.411 | k star (bias corrected MLE) | 0.396 |
| Theta hat (MLE) | 2.1479E-5 | Theta star (bias corrected MLE) | 2.2286E-5 |
| nu hat (MLE) | 31.2 | nu star (bias corrected) | 30.07 |
| Mean (detects) | 8.8186E-6 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.1300E-7 | Mean | 7.3988E-4 |
| Maximum | 0.01 | Median | 1.4000E-6 |
| SD | 0.00263 | CV | 3.56 |
| k hat (MLE) | 0.143 | k star (bias corrected MLE) | 0.149 |
| Theta hat (MLE) | 0.00516 | Theta star (bias corrected MLE) | 0.00496 |
| nu hat (MLE) | 11.76 | nu star (bias corrected) | 12.23 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (12.23, α) | 5.38 | Adjusted Chi Square Value (12.23, β) | 5.214 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00168 | 95% Gamma Adjusted UCL (use when n<50) | 0.00174 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 8.1956E-6 | SD (KM) | 2.1786E-5 |
| Variance (KM) | 4.746E-10 | SE of Mean (KM) | 3.4481E-6 |
| k hat (KM) | 0.142 | k star (KM) | 0.147 |
| nu hat (KM) | 11.6 | nu star (KM) | 12.09 |
| theta hat (KM) | 5.7912E-5 | theta star (KM) | 5.5592E-5 |
| 80% gamma percentile (KM) | 8.7939E-6 | 90% gamma percentile (KM) | 2.4242E-5 |
| 95% gamma percentile (KM) | 4.5258E-5 | 99% gamma percentile (KM) | 1.0646E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (12.09, α) | 5.285 | Adjusted Chi Square Value (12.09, β) | 5.121 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.8745E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.9346E-5 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.956 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.938 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.121 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.142 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 8.1916E-6 | Mean in Log Scale | -13.45 |
| SD in Original Scale | 2.2058E-5 | SD in Log Scale | 1.821 |
| 95% t UCL (assumes normality of ROS data) | 1.3992E-5 | 95% Percentile Bootstrap UCL | 1.4230E-5 |
| 95% BCA Bootstrap UCL | 1.7920E-5 | 95% Bootstrap t UCL | 2.5135E-5 |
| 95% H-UCL (Log ROS) | 2.0133E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -13.47 | KM Geo Mean | 1.4170E-6 |
| KM SD (logged) | 1.848 | 95% Critical H Value (KM-Log) | 3.427 |
| KM Standard Error of Mean (logged) | 0.295 | 95% H-UCL (KM -Log) | 2.1279E-5 |
| KM SD (logged) | 1.848 | 95% Critical H Value (KM-Log) | 3.427 |
| KM Standard Error of Mean (logged) | 0.295 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 8.2108E-6 | Mean in Log Scale | -13.45 |
| SD in Original Scale | 2.2051E-5 | SD in Log Scale | 1.871 |
| 95% t UCL (Assumes normality) | 1.4010E-5 | 95% H-Stat UCL | 2.3183E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 2.32E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|2,3,7,8-Tetrachlorodibenzo-p-dioxin

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 34 | Number of Non-Detects | 7 |
| Number of Distinct Detects | 33 | Number of Distinct Non-Detects | 7 |
| Minimum Detect | 5.9300E-8 | Minimum Non-Detect | 1.3100E-8 |
| Maximum Detect | 3.8200E-5 | Maximum Non-Detect | 5.2000E-7 |
| Variance Detects | 5.517E-11 | Percent Non-Detects | 17.07% |
| Mean Detects | 3.1995E-6 | SD Detects | 7.4278E-6 |
| Median Detects | 7.9150E-7 | CV Detects | N/A |
| Skewness Detects | 3.868 | Kurtosis Detects | 15.99 |
| Mean of Logged Detects | -13.85 | SD of Logged Detects | 1.436 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.439 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.933 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.361 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.15 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 2.66E-06 | KM Standard Error of Mean | 1.0730E-6 |
| KM SD | 6.7689E-6 | 95% KM (BCA) UCL | 4.7485E-6 |
| 95% KM (t) UCL | 4.4677E-6 | 95% KM (Percentile Bootstrap) UCL | 4.6961E-6 |
| 95% KM (z) UCL | 4.4259E-6 | 95% KM Bootstrap t UCL | 7.6499E-6 |
| 90% KM Chebyshev UCL | 5.8800E-6 | 95% KM Chebyshev UCL | 7.3381E-6 |
| 97.5% KM Chebyshev UCL | 9.3619E-6 | 99% KM Chebyshev UCL | 1.3337E-5 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 2.438 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.809 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.216 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.159 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.526 | k star (bias corrected MLE) | 0.499 |
| Theta hat (MLE) | 6.0842E-6 | Theta star (bias corrected MLE) | 6.4108E-6 |
| nu hat (MLE) | 35.76 | nu star (bias corrected) | 33.94 |
| Mean (detects) | 3.1995E-6 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 5.9300E-8 | Mean | 0.00171 |
| Maximum | 0.01 | Median | 1.0500E-6 |
| SD | 0.00381 | CV | 2.227 |
| k hat (MLE) | 0.133 | k star (bias corrected MLE) | 0.139 |
| Theta hat (MLE) | 0.0129 | Theta star (bias corrected MLE) | 0.0123 |
| nu hat (MLE) | 10.87 | nu star (bias corrected) | 11.41 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (11.41, α) | 4.84 | Adjusted Chi Square Value (11.41, β) | 4.683 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00403 | 95% Gamma Adjusted UCL (use when n<50) | 0.00417 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 2.6609E-6 | SD (KM) | 6.7689E-6 |
| Variance (KM) | 4.582E-11 | SE of Mean (KM) | 1.0730E-6 |
| k hat (KM) | 0.155 | k star (KM) | 0.159 |
| nu hat (KM) | 12.67 | nu star (KM) | 13.08 |
| theta hat (KM) | 1.7219E-5 | theta star (KM) | 1.6684E-5 |
| 80% gamma percentile (KM) | 3.0392E-6 | 90% gamma percentile (KM) | 7.9498E-6 |
| 95% gamma percentile (KM) | 1.4465E-5 | 99% gamma percentile (KM) | 3.3139E-5 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (13.08, α) | 5.945 | Adjusted Chi Square Value (13.08, β) | 5.769 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 5.8534E-6 | 95% Gamma Adjusted KM-UCL (use when n<50) | 6.0317E-6 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.933 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.111 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.15 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 2.6630E-6 | Mean in Log Scale | -14.35 |
| SD in Original Scale | 6.8521E-6 | SD in Log Scale | 1.73 |
| 95% t UCL (assumes normality of ROS data) | 4.4649E-6 | 95% Percentile Bootstrap UCL | 4.5173E-6 |
| 95% BCA Bootstrap UCL | 5.4488E-6 | 95% Bootstrap t UCL | 7.5728E-6 |
| 95% H-UCL (Log ROS) | 6.3751E-6 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -14.5 | KM Geo Mean | 5.0339E-7 |
| KM SD (logged) | 1.969 | 95% Critical H Value (KM-Log) | 3.597 |
| KM Standard Error of Mean (logged) | 0.317 | 95% H-UCL (KM -Log) | 1.0731E-5 |
| KM SD (logged) | 1.969 | 95% Critical H Value (KM-Log) | 3.597 |
| KM Standard Error of Mean (logged) | 0.317 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 2.6636E-6 | Mean in Log Scale | -14.46 |
| SD in Original Scale | 6.8519E-6 | SD in Log Scale | 1.957 |
| 95% t UCL (Assumes normality) | 4.4655E-6 | 95% H-Stat UCL | 1.0767E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

KM H-UCL 1.07E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,4,7,8,9-Heptachlorodibenzofuran

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 37 | Number of Non-Detects | 4 |
| Number of Distinct Detects | 35 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 8.0000E-8 | Minimum Non-Detect | 9.5000E-8 |
| Maximum Detect | 1.5100E-4 | Maximum Non-Detect | 4.1000E-6 |
| Variance Detects | 7.873E-10 | Percent Non-Detects | 9.756% |
| Mean Detects | 1.0359E-5 | SD Detects | 2.8060E-5 |
| Median Detects | 1.7700E-6 | CV Detects | N/A |
| Skewness Detects | 4.223 | Kurtosis Detects | 18.98 |
| Mean of Logged Detects | -12.92 | SD of Logged Detects | 1.508 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.39 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.936 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.401 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.144 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 9.43E-06 | KM Standard Error of Mean | 4.1871E-6 |
| KM SD | 2.6445E-5 | 95% KM (BCA) UCL | 1.6936E-5 |
| 95% KM (t) UCL | 1.6484E-5 | 95% KM (Percentile Bootstrap) UCL | 1.6816E-5 |
| 95% KM (z) UCL | 1.6321E-5 | 95% KM Bootstrap t UCL | 3.6407E-5 |
| 90% KM Chebyshev UCL | 2.1995E-5 | 95% KM Chebyshev UCL | 2.7685E-5 |
| 97.5% KM Chebyshev UCL | 3.5582E-5 | 99% KM Chebyshev UCL | 5.1094E-5 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 3.658 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.824 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.267 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.154 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.447 | k star (bias corrected MLE) | 0.429 |
| Theta hat (MLE) | 2.3186E-5 | Theta star (bias corrected MLE) | 2.4171E-5 |
| nu hat (MLE) | 33.06 | nu star (bias corrected) | 31.72 |
| Mean (detects) | 1.0359E-5 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 8.0000E-8 | Mean | 9.8496E-4 |
| Maximum | 0.01 | Median | 2.1400E-6 |
| SD | 0.003 | CV | 3.047 |
| k hat (MLE) | 0.148 | k star (bias corrected MLE) | 0.154 |
| Theta hat (MLE) | 0.00664 | Theta star (bias corrected MLE) | 0.00641 |
| nu hat (MLE) | 12.16 | nu star (bias corrected) | 12.61 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (12.61, α) | 5.629 | Adjusted Chi Square Value (12.61, β) | 5.459 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00221 | 95% Gamma Adjusted UCL (use when n<50) | 0.00227 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 9.4337E-6 | SD (KM) | 2.6445E-5 |
| Variance (KM) | 6.993E-10 | SE of Mean (KM) | 4.1871E-6 |
| k hat (KM) | 0.127 | k star (KM) | 0.134 |
| nu hat (KM) | 10.44 | nu star (KM) | 11.01 |
| theta hat (KM) | 7.4130E-5 | theta star (KM) | 7.0292E-5 |
| 80% gamma percentile (KM) | 9.3005E-6 | 90% gamma percentile (KM) | 2.7450E-5 |
| 95% gamma percentile (KM) | 5.2966E-5 | 99% gamma percentile (KM) | 1.2880E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (11.01, α) | 4.579 | Adjusted Chi Square Value (11.01, β) | 4.428 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 2.2672E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 2.3446E-5 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.948 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.936 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.148 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.144 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data appear Approximate Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 9.4223E-6 | Mean in Log Scale | -13.08 |
| SD in Original Scale | 2.6776E-5 | SD in Log Scale | 1.538 |
| 95% t UCL (assumes normality of ROS data) | 1.6464E-5 | 95% Percentile Bootstrap UCL | 1.7171E-5 |
| 95% BCA Bootstrap UCL | 1.9963E-5 | 95% Bootstrap t UCL | 3.3956E-5 |
| 95% H-UCL (Log ROS) | 1.4200E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -13.09 | KM Geo Mean | 2.0673E-6 |
| KM SD (logged) | 1.554 | 95% Critical H Value (KM-Log) | 3.027 |
| KM Standard Error of Mean (logged) | 0.25 | 95% H-UCL (KM -Log) | 1.4551E-5 |
| KM SD (logged) | 1.554 | 95% Critical H Value (KM-Log) | 3.027 |
| KM Standard Error of Mean (logged) | 0.25 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 9.4658E-6 | Mean in Log Scale | -13.06 |
| SD in Original Scale | 2.6763E-5 | SD in Log Scale | 1.567 |
| 95% t UCL (Assumes normality) | 1.6504E-5 | 95% H-Stat UCL | 1.5454E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 2.77E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 40 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 39 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 2.0900E-7 | Minimum Non-Detect | 1.1000E-6 |
| Maximum Detect | 7.0500E-4 | Maximum Non-Detect | 1.1000E-6 |
| Variance Detects | 1.6674E-8 | Percent Non-Detects | 2.439% |
| Mean Detects | 4.3120E-5 | SD Detects | 1.2913E-4 |
| Median Detects | 6.0600E-6 | CV Detects | N/A |
| Skewness Detects | 4.33 | Kurtosis Detects | 19.64 |
| Mean of Logged Detects | -11.76 | SD of Logged Detects | 1.627 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.359 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.94 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.431 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.139 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 4.21E-05 | KM Standard Error of Mean | 1.9946E-5 |
| KM SD | 1.2611E-4 | 95% KM (BCA) UCL | 7.8754E-5 |
| 95% KM (t) UCL | 7.5668E-5 | 95% KM (Percentile Bootstrap) UCL | 7.7672E-5 |
| 95% KM (z) UCL | 7.4890E-5 | 95% KM Bootstrap t UCL | 1.6353E-4 |
| 90% KM Chebyshev UCL | 1.0192E-4 | 95% KM Chebyshev UCL | 1.2903E-4 |
| 97.5% KM Chebyshev UCL | 1.6665E-4 | 99% KM Chebyshev UCL | 2.4054E-4 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 4.203 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.838 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.268 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.15 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.387 | k star (bias corrected MLE) | 0.375 |
| Theta hat (MLE) | 1.1146E-4 | Theta star (bias corrected MLE) | 1.1514E-4 |
| nu hat (MLE) | 30.95 | nu star (bias corrected) | 29.96 |
| Mean (detects) | 4.3120E-5 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 2.0900E-7 | Mean | 2.8597E-4 |
| Maximum | 0.01 | Median | 6.0700E-6 |
| SD | 0.00156 | CV | 5.456 |
| k hat (MLE) | 0.213 | k star (bias corrected MLE) | 0.213 |
| Theta hat (MLE) | 0.00134 | Theta star (bias corrected MLE) | 0.00134 |
| nu hat (MLE) | 17.44 | nu star (bias corrected) | 17.49 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (17.49, α) | 9.027 | Adjusted Chi Square Value (17.49, β) | 8.804 |
| 95% Gamma Approximate UCL (use when n>=50) | 5.5424E-4 | 95% Gamma Adjusted UCL (use when n<50) | 5.6826E-4 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 4.2081E-5 | SD (KM) | 1.2611E-4 |
| Variance (KM) | 1.5904E-8 | SE of Mean (KM) | 1.9946E-5 |
| k hat (KM) | 0.111 | k star (KM) | 0.119 |
| nu hat (KM) | 9.13 | nu star (KM) | 9.796 |
| theta hat (KM) | 3.7794E-4 | theta star (KM) | 3.5227E-4 |
| 80% gamma percentile (KM) | 3.6718E-5 | 90% gamma percentile (KM) | 1.1908E-4 |
| 95% gamma percentile (KM) | 2.4027E-4 | 99% gamma percentile (KM) | 6.1059E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (9.80, α) | 3.814 | Adjusted Chi Square Value (9.80, β) | 3.679 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.0807E-4 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.1206E-4 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.951 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.94 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.112 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.139 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 4.2076E-5 | Mean in Log Scale | -11.84 |
| SD in Original Scale | 1.2768E-4 | SD in Log Scale | 1.681 |
| 95% t UCL (assumes normality of ROS data) | 7.5653E-5 | 95% Percentile Bootstrap UCL | 7.7665E-5 |
| 95% BCA Bootstrap UCL | 9.9662E-5 | 95% Bootstrap t UCL | 1.6777E-4 |
| 95% H-UCL (Log ROS) | 6.9348E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -11.83 | KM Geo Mean | 7.2648E-6 |
| KM SD (logged) | 1.653 | 95% Critical H Value (KM-Log) | 3.159 |
| KM Standard Error of Mean (logged) | 0.262 | 95% H-UCL (KM -Log) | 6.4977E-5 |
| KM SD (logged) | 1.653 | 95% Critical H Value (KM-Log) | 3.159 |
| KM Standard Error of Mean (logged) | 0.262 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 4.2082E-5 | Mean in Log Scale | -11.83 |
| SD in Original Scale | 1.2768E-4 | SD in Log Scale | 1.659 |
| 95% t UCL (Assumes normality) | 7.5658E-5 | 95% H-Stat UCL | 6.6451E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 1.29E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Surface Sediment

RA18_SE_DioxinFurans|2,3,4,6,7,8-Hexachlorodibenzofuran

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 39 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 39 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 7.3700E-8 | Minimum Non-Detect | 3.0000E-7 |
| Maximum Detect | 2.8500E-4 | Maximum Non-Detect | 6.4000E-6 |
| Variance Detects | 2.6320E-9 | Percent Non-Detects | 4.878% |
| Mean Detects | 1.9695E-5 | SD Detects | 5.1303E-5 |
| Median Detects | 3.1000E-6 | CV Detects | N/A |
| Skewness Detects | 4.31 | Kurtosis Detects | 20.15 |
| Mean of Logged Detects | -12.4 | SD of Logged Detects | 1.7 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.413 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.351 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 1.88E-05 | KM Standard Error of Mean | 7.8403E-6 |
| KM SD | 4.9554E-5 | 95% KM (BCA) UCL | 3.3574E-5 |
| 95% KM (t) UCL | 3.1989E-5 | 95% KM (Percentile Bootstrap) UCL | 3.3080E-5 |
| 95% KM (z) UCL | 3.1683E-5 | 95% KM Bootstrap t UCL | 5.8218E-5 |
| 90% KM Chebyshev UCL | 4.2308E-5 | 95% KM Chebyshev UCL | 5.2962E-5 |
| 97.5% KM Chebyshev UCL | 6.7749E-5 | 99% KM Chebyshev UCL | 9.6796E-5 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 2.686 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.831 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.23 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.151 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.418 | k star (bias corrected MLE) | 0.403 |
| Theta hat (MLE) | 4.7078E-5 | Theta star (bias corrected MLE) | 4.8840E-5 |
| nu hat (MLE) | 32.63 | nu star (bias corrected) | 31.45 |
| Mean (detects) | 1.9695E-5 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 7.3700E-8 | Mean | 5.0654E-4 |
| Maximum | 0.01 | Median | 3.5000E-6 |
| SD | 0.00218 | CV | 4.298 |
| k hat (MLE) | 0.17 | k star (bias corrected MLE) | 0.174 |
| Theta hat (MLE) | 0.00297 | Theta star (bias corrected MLE) | 0.00291 |
| nu hat (MLE) | 13.97 | nu star (bias corrected) | 14.28 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (14.28, α) | 6.761 | Adjusted Chi Square Value (14.28, β) | 6.572 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00107 | 95% Gamma Adjusted UCL (use when n<50) | 0.0011 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 1.8787E-5 | SD (KM) | 4.9554E-5 |
| Variance (KM) | 2.4556E-9 | SE of Mean (KM) | 7.8403E-6 |
| k hat (KM) | 0.144 | k star (KM) | 0.149 |
| nu hat (KM) | 11.79 | nu star (KM) | 12.26 |
| theta hat (KM) | 1.3071E-4 | theta star (KM) | 1.2568E-4 |
| 80% gamma percentile (KM) | 2.0392E-5 | 90% gamma percentile (KM) | 5.5682E-5 |
| 95% gamma percentile (KM) | 1.0347E-4 | 99% gamma percentile (KM) | 2.4225E-4 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (12.26, α) | 5.397 | Adjusted Chi Square Value (12.26, β) | 5.231 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 4.2668E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 4.4025E-5 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.973 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.939 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.114 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.14 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.8779E-5 | Mean in Log Scale | -12.51 |
| SD in Original Scale | 5.0171E-5 | SD in Log Scale | 1.758 |
| 95% t UCL (assumes normality of ROS data) | 3.1973E-5 | 95% Percentile Bootstrap UCL | 3.2629E-5 |
| 95% BCA Bootstrap UCL | 3.8918E-5 | 95% Bootstrap t UCL | 6.2047E-5 |
| 95% H-UCL (Log ROS) | 4.3443E-5 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -12.52 | KM Geo Mean | 3.6481E-6 |
| KM SD (logged) | 1.765 | 95% Critical H Value (KM-Log) | 3.313 |
| KM Standard Error of Mean (logged) | 0.281 | 95% H-UCL (KM -Log) | 4.3690E-5 |
| KM SD (logged) | 1.765 | 95% Critical H Value (KM-Log) | 3.313 |
| KM Standard Error of Mean (logged) | 0.281 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 1.8816E-5 | Mean in Log Scale | -12.48 |
| SD in Original Scale | 5.0159E-5 | SD in Log Scale | 1.736 |
| 95% t UCL (Assumes normality) | 3.2006E-5 | 95% H-Stat UCL | 4.2006E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

95% KM (Chebyshev) UCL 5.30E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|2,3,4,7,8-Pentachlorodibenzofuran

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 40 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 38 | Number of Non-Detects | 3 |
| Number of Distinct Detects | 37 | Number of Distinct Non-Detects | 3 |
| Minimum Detect | 3.4500E-7 | Minimum Non-Detect | 1.5600E-8 |
| Maximum Detect | 2.1700E-4 | Maximum Non-Detect | 5.8000E-6 |
| Variance Detects | 1.6492E-9 | Percent Non-Detects | 7.317% |
| Mean Detects | 1.7563E-5 | SD Detects | 4.0610E-5 |
| Median Detects | 2.9250E-6 | CV Detects | N/A |
| Skewness Detects | 3.997 | Kurtosis Detects | 17.18 |
| Mean of Logged Detects | -12.23 | SD of Logged Detects | 1.516 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.45 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.938 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.336 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.142 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 1.63E-05 | KM Standard Error of Mean | 6.1454E-6 |
| KM SD | 3.8828E-5 | 95% KM (BCA) UCL | 2.8991E-5 |
| 95% KM (t) UCL | 2.6680E-5 | 95% KM (Percentile Bootstrap) UCL | 2.7637E-5 |
| 95% KM (z) UCL | 2.6441E-5 | 95% KM Bootstrap t UCL | 4.8091E-5 |
| 90% KM Chebyshev UCL | 3.4768E-5 | 95% KM Chebyshev UCL | 4.3119E-5 |
| 97.5% KM Chebyshev UCL | 5.4710E-5 | 99% KM Chebyshev UCL | 7.7478E-5 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 2.399 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.814 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.203 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.151 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.495 | k star (bias corrected MLE) | 0.473 |
| Theta hat (MLE) | 3.5481E-5 | Theta star (bias corrected MLE) | 3.7095E-5 |
| nu hat (MLE) | 37.62 | nu star (bias corrected) | 35.98 |
| Mean (detects) | 1.7563E-5 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 3.4500E-7 | Mean | 7.4799E-4 |
| Maximum | 0.01 | Median | 4.9300E-6 |
| SD | 0.00263 | CV | 3.519 |
| k hat (MLE) | 0.169 | k star (bias corrected MLE) | 0.173 |
| Theta hat (MLE) | 0.00443 | Theta star (bias corrected MLE) | 0.00433 |
| nu hat (MLE) | 13.83 | nu star (bias corrected) | 14.15 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (14.15, α) | 6.676 | Adjusted Chi Square Value (14.15, β) | 6.488 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00159 | 95% Gamma Adjusted UCL (use when n<50) | 0.00163 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 1.6332E-5 | SD (KM) | 3.8828E-5 |
| Variance (KM) | 1.5076E-9 | SE of Mean (KM) | 6.1454E-6 |
| k hat (KM) | 0.177 | k star (KM) | 0.18 |
| nu hat (KM) | 14.51 | nu star (KM) | 14.78 |
| theta hat (KM) | 9.2307E-5 | theta star (KM) | 9.0610E-5 |
| 80% gamma percentile (KM) | 2.0280E-5 | 90% gamma percentile (KM) | 4.9259E-5 |
| 95% gamma percentile (KM) | 8.6370E-5 | 99% gamma percentile (KM) | 1.9036E-4 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (14.78, α) | 7.109 | Adjusted Chi Square Value (14.78, β) | 6.914 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 3.3956E-5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 3.4912E-5 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.956 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.938 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.151 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.142 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data appear Approximate Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.6328E-5 | Mean in Log Scale | -12.43 |
| SD in Original Scale | 3.9311E-5 | SD in Log Scale | 1.651 |
| 95% t UCL (assumes normality of ROS data) | 2.6666E-5 | 95% Percentile Bootstrap UCL | 2.8082E-5 |
| 95% BCA Bootstrap UCL | 3.2415E-5 | 95% Bootstrap t UCL | 4.8394E-5 |
| 95% H-UCL (Log ROS) | 3.5583E-5 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -12.51 | KM Geo Mean | 3.6915E-6 |
| KM SD (logged) | 1.837 | 95% Critical H Value (KM-Log) | 3.412 |
| KM Standard Error of Mean (logged) | 0.297 | 95% H-UCL (KM -Log) | 5.3792E-5 |
| KM SD (logged) | 1.837 | 95% Critical H Value (KM-Log) | 3.412 |
| KM Standard Error of Mean (logged) | 0.297 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.6353E-5 | Mean in Log Scale | -12.48 |
| SD in Original Scale | 3.9302E-5 | SD in Log Scale | 1.836 |
| 95% t UCL (Assumes normality) | 2.6688E-5 | 95% H-Stat UCL | 5.4993E-5 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 4.31E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|beta-BHC

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 34 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 11 | Number of Non-Detects | 38 |
| Number of Distinct Detects | 10 | Number of Distinct Non-Detects | 25 |
| Minimum Detect | 2.9000E-4 | Minimum Non-Detect | 8.7000E-5 |
| Maximum Detect | 0.0039 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 1.0672E-6 | Percent Non-Detects | 77.55% |
| Mean Detects | 0.00113 | SD Detects | 0.00103 |
| Median Detects | 8.5500E-4 | CV Detects | 0.916 |
| Skewness Detects | 2.265 | Kurtosis Detects | 5.615 |
| Mean of Logged Detects | -7.065 | SD of Logged Detects | 0.747 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.729 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.329 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 3.77E-04 | KM Standard Error of Mean | 1.0091E-4 |
| KM SD | 6.4162E-4 | 95% KM (BCA) UCL | 5.7845E-4 |
| 95% KM (t) UCL | 5.4592E-4 | 95% KM (Percentile Bootstrap) UCL | 5.5456E-4 |
| 95% KM (z) UCL | 5.4266E-4 | 95% KM Bootstrap t UCL | 6.1363E-4 |
| 90% KM Chebyshev UCL | 6.7940E-4 | 95% KM Chebyshev UCL | 8.1652E-4 |
| 97.5% KM Chebyshev UCL | 0.00101 | 99% KM Chebyshev UCL | 0.00138 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.445 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.739 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.236 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.259 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.949 | k star (bias corrected MLE) | 1.478 |
| Theta hat (MLE) | 5.7858E-4 | Theta star (bias corrected MLE) | 7.6292E-4 |
| nu hat (MLE) | 42.88 | nu star (bias corrected) | 32.52 |
| Mean (detects) | 0.00113 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 2.9000E-4 | Mean | 0.00801 |
| Maximum | 0.01 | Median | 0.01 |
| SD | 0.00377 | CV | 0.471 |
| k hat (MLE) | 1.661 | k star (bias corrected MLE) | 1.573 |
| Theta hat (MLE) | 0.00482 | Theta star (bias corrected MLE) | 0.00509 |
| nu hat (MLE) | 162.8 | nu star (bias corrected) | 154.2 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (154.18, α) | 126.5 | Adjusted Chi Square Value (154.18, β) | 125.7 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00976 | 95% Gamma Adjusted UCL (use when n<50) | 0.00982 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 3.7668E-4 | SD (KM) | 6.4162E-4 |
| Variance (KM) | 4.1167E-7 | SE of Mean (KM) | 1.0091E-4 |
| k hat (KM) | 0.345 | k star (KM) | 0.337 |
| nu hat (KM) | 33.78 | nu star (KM) | 33.04 |
| theta hat (KM) | 0.00109 | theta star (KM) | 0.00112 |
| 80% gamma percentile (KM) | 5.9245E-4 | 90% gamma percentile (KM) | 0.00109 |
| 95% gamma percentile (KM) | 0.00166 | 99% gamma percentile (KM) | 0.00311 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (33.04, α) | 20.9 | Adjusted Chi Square Value (33.04, β) | 20.61 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 5.9551E-4 | 95% Gamma Adjusted KM-UCL (use when n<50) | 6.0400E-4 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.962 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.185 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 3.6245E-4 | Mean in Log Scale | -8.569 |
| SD in Original Scale | 6.3328E-4 | SD in Log Scale | 0.992 |
| 95% t UCL (assumes normality of ROS data) | 5.1418E-4 | 95% Percentile Bootstrap UCL | 5.2920E-4 |
| 95% BCA Bootstrap UCL | 5.7655E-4 | 95% Bootstrap t UCL | 6.6324E-4 |
| 95% H-UCL (Log ROS) | 4.3346E-4 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -8.632 | KM Geo Mean | 1.7839E-4 |
| KM SD (logged) | 1.077 | 95% Critical H Value (KM-Log) | 2.424 |
| KM Standard Error of Mean (logged) | 0.193 | 95% H-UCL (KM -Log) | 4.6461E-4 |
| KM SD (logged) | 1.077 | 95% Critical H Value (KM-Log) | 2.424 |
| KM Standard Error of Mean (logged) | 0.193 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 4.9932E-4 | Mean in Log Scale | -8.131 |
| SD in Original Scale | 6.1546E-4 | SD in Log Scale | 1.097 |
| 95% t UCL (Assumes normality) | 6.4678E-4 | 95% H-Stat UCL | 7.9073E-4 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Gamma Distributed at 5% Significance Level**

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 6.04E-04 | 95% GROS Adjusted Gamma UCL | 0.00982 |

**Warning: Recommended UCL exceeds the maximum observation**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**RA18_SE_PestPCBs|delta-BHC**

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 34 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 20 | Number of Non-Detects | 29 |
| Number of Distinct Detects | 16 | Number of Distinct Non-Detects | 20 |
| Minimum Detect | 1.8000E-4 | Minimum Non-Detect | 5.3000E-5 |
| Maximum Detect | 0.0055 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 1.4577E-6 | Percent Non-Detects | 59.18% |
| Mean Detects | 0.0012 | SD Detects | 0.00121 |
| Median Detects | 7.6500E-4 | CV Detects | 1.008 |
| Skewness Detects | 2.585 | Kurtosis Detects | 8.341 |
| Mean of Logged Detects | -7.083 | SD of Logged Detects | 0.847 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.717 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.905 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.215 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.192 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 6.05E-04 | KM Standard Error of Mean | 1.3776E-4 |
| KM SD | 9.1686E-4 | 95% KM (BCA) UCL | 8.5328E-4 |
| 95% KM (t) UCL | 8.3587E-4 | 95% KM (Percentile Bootstrap) UCL | 8.3124E-4 |
| 95% KM (z) UCL | 8.3141E-4 | 95% KM Bootstrap t UCL | 9.3963E-4 |
| 90% KM Chebyshev UCL | 0.00102 | 95% KM Chebyshev UCL | 0.00121 |
| 97.5% KM Chebyshev UCL | 0.00147 | 99% KM Chebyshev UCL | 0.00198 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.48 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.757 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.143 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.197 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.551 | k star (bias corrected MLE) | 1.352 |
| Theta hat (MLE) | 7.7235E-4 | Theta star (bias corrected MLE) | 8.8624E-4 |
| nu hat (MLE) | 62.04 | nu star (bias corrected) | 54.07 |
| Mean (detects) | 0.0012 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.8000E-4 | Mean | 0.00641 |
| Maximum | 0.01 | Median | 0.01 |
| SD | 0.00444 | CV | 0.692 |
| k hat (MLE) | 1.017 | k star (bias corrected MLE) | 0.969 |
| Theta hat (MLE) | 0.0063 | Theta star (bias corrected MLE) | 0.00661 |
| nu hat (MLE) | 99.71 | nu star (bias corrected) | 94.94 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (94.94, α) | 73.47 | Adjusted Chi Square Value (94.94, β) | 72.89 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00828 | 95% Gamma Adjusted UCL (use when n<50) | 0.00835 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 6.0481E-4 | SD (KM) | 9.1686E-4 |
| Variance (KM) | 8.4063E-7 | SE of Mean (KM) | 1.3776E-4 |
| k hat (KM) | 0.435 | k star (KM) | 0.422 |
| nu hat (KM) | 42.64 | nu star (KM) | 41.37 |
| theta hat (KM) | 0.00139 | theta star (KM) | 0.00143 |
| 80% gamma percentile (KM) | 9.8173E-4 | 90% gamma percentile (KM) | 0.00169 |
| 95% gamma percentile (KM) | 0.00247 | 99% gamma percentile (KM) | 0.0044 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (41.37, α) | 27.63 | Adjusted Chi Square Value (41.37, β) | 27.28 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 9.0565E-4 | 95% Gamma Adjusted KM-UCL (use when n<50) | 9.1697E-4 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.976 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.905 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.114 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.192 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 6.0504E-4 | Mean in Log Scale | -8.03 |
| SD in Original Scale | 9.1263E-4 | SD in Log Scale | 1.04 |
| 95% t UCL (assumes normality of ROS data) | 8.2371E-4 | 95% Percentile Bootstrap UCL | 8.2949E-4 |
| 95% BCA Bootstrap UCL | 9.2281E-4 | 95% Bootstrap t UCL | 9.8253E-4 |
| 95% H-UCL (Log ROS) | 7.9919E-4 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -8.297 | KM Geo Mean | 2.4920E-4 |
| KM SD (logged) | 1.383 | 95% Critical H Value (KM-Log) | 2.786 |
| KM Standard Error of Mean (logged) | 0.244 | 95% H-UCL (KM -Log) | 0.00113 |
| KM SD (logged) | 1.383 | 95% Critical H Value (KM-Log) | 2.786 |
| KM Standard Error of Mean (logged) | 0.244 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 6.8961E-4 | Mean in Log Scale | -7.85 |
| SD in Original Scale | 8.8743E-4 | SD in Log Scale | 1.165 |
| 95% t UCL (Assumes normality) | 9.0224E-4 | 95% H-Stat UCL | 0.00117 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Gamma Distributed at 5% Significance Level

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 9.1697E-4 | 95% GROS Adjusted Gamma UCL | 0.00835 |

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Endosulfan II

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 34 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 30 | Number of Non-Detects | 19 |
| Number of Distinct Detects | 25 | Number of Distinct Non-Detects | 12 |
| Minimum Detect | 1.8000E-4 | Minimum Non-Detect | 7.6000E-5 |
| Maximum Detect | 0.0068 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 2.4568E-6 | Percent Non-Detects | 38.78% |
| Mean Detects | 0.00137 | SD Detects | 0.00157 |
| Median Detects | 7.8000E-4 | CV Detects | 1.142 |
| Skewness Detects | 2.161 | Kurtosis Detects | 4.636 |
| Mean of Logged Detects | -7.078 | SD of Logged Detects | 0.984 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.718 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.267 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 9.89E-04 | KM Standard Error of Mean | 1.9261E-4 |
| KM SD | 0.00131 | 95% KM (BCA) UCL | 0.00136 |
| 95% KM (t) UCL | 0.00131 | 95% KM (Percentile Bootstrap) UCL | 0.00132 |
| 95% KM (z) UCL | 0.00131 | 95% KM Bootstrap t UCL | 0.00148 |
| 90% KM Chebyshev UCL | 0.00157 | 95% KM Chebyshev UCL | 0.00183 |
| 97.5% KM Chebyshev UCL | 0.00219 | 99% KM Chebyshev UCL | 0.00291 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.823 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.771 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.142 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.164 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.167 | k star (bias corrected MLE) | 1.072 |
| Theta hat (MLE) | 0.00118 | Theta star (bias corrected MLE) | 0.00128 |
| nu hat (MLE) | 70 | nu star (bias corrected) | 64.33 |
| Mean (detects) | 0.00137 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 1.8000E-4 | Mean | 0.00472 |
| Maximum | 0.01 | Median | 0.0022 |
| SD | 0.00442 | CV | 0.937 |
| k hat (MLE) | 0.781 | k star (bias corrected MLE) | 0.747 |
| Theta hat (MLE) | 0.00604 | Theta star (bias corrected MLE) | 0.00632 |
| nu hat (MLE) | 76.52 | nu star (bias corrected) | 73.17 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (73.17, α) | 54.47 | Adjusted Chi Square Value (73.17, β) | 53.98 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00634 | 95% Gamma Adjusted UCL (use when n<50) | 0.00639 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 9.8876E-4 | SD (KM) | 0.00131 |
| Variance (KM) | 1.7174E-6 | SE of Mean (KM) | 1.9261E-4 |
| k hat (KM) | 0.569 | k star (KM) | 0.548 |
| nu hat (KM) | 55.79 | nu star (KM) | 53.71 |
| theta hat (KM) | 0.00174 | theta star (KM) | 0.0018 |
| 80% gamma percentile (KM) | 0.00163 | 90% gamma percentile (KM) | 0.00262 |
| 95% gamma percentile (KM) | 0.00368 | 99% gamma percentile (KM) | 0.00624 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (53.71, α) | 37.87 | Adjusted Chi Square Value (53.71, β) | 37.47 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0014 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.00142 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.964 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0794 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 9.7557E-4 | Mean in Log Scale | -7.487 |
| SD in Original Scale | 0.00132 | SD in Log Scale | 1.01 |
| 95% t UCL (assumes normality of ROS data) | 0.00129 | 95% Percentile Bootstrap UCL | 0.0013 |
| 95% BCA Bootstrap UCL | 0.00141 | 95% Bootstrap t UCL | 0.00144 |
| 95% H-UCL (Log ROS) | 0.00131 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -7.522 | KM Geo Mean | 5.4095E-4 |
| KM SD (logged) | 1.1 | 95% Critical H Value (KM-Log) | 2.449 |
| KM Standard Error of Mean (logged) | 0.182 | 95% H-UCL (KM -Log) | 0.00146 |
| KM SD (logged) | 1.1 | 95% Critical H Value (KM-Log) | 2.449 |
| KM Standard Error of Mean (logged) | 0.182 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00102 | Mean in Log Scale | -7.396 |
| SD in Original Scale | 0.0013 | SD in Log Scale | 1.01 |
| 95% t UCL (Assumes normality) | 0.00133 | 95% H-Stat UCL | 0.00144 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 0.00142 | 95% GROS Adjusted Gamma UCL | 0.00639 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|gamma-BHC (Lindane)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 35 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 27 | Number of Non-Detects | 22 |
| Number of Distinct Detects | 22 | Number of Distinct Non-Detects | 15 |
| Minimum Detect | 7.7000E-5 | Minimum Non-Detect | 7.2000E-5 |
| Maximum Detect | 0.0016 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 1.8278E-7 | Percent Non-Detects | 44.9% |
| Mean Detects | 4.8226E-4 | SD Detects | 4.2753E-4 |
| Median Detects | 3.0000E-4 | CV Detects | 0.887 |
| Skewness Detects | 1.51 | Kurtosis Detects | 1.357 |
| Mean of Logged Detects | -7.97 | SD of Logged Detects | 0.828 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.792 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.221 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.167 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 3.66E-04 | KM Standard Error of Mean | 5.6497E-5 |
| KM SD | 3.6123E-4 | 95% KM (BCA) UCL | 4.6496E-4 |
| 95% KM (t) UCL | 4.6089E-4 | 95% KM (Percentile Bootstrap) UCL | 4.6169E-4 |
| 95% KM (z) UCL | 4.5906E-4 | 95% KM Bootstrap t UCL | 4.7986E-4 |
| 90% KM Chebyshev UCL | 5.3562E-4 | 95% KM Chebyshev UCL | 6.1240E-4 |
| 97.5% KM Chebyshev UCL | 7.1895E-4 | 99% KM Chebyshev UCL | 9.2827E-4 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.69 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.761 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.171 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.171 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.65 | k star (bias corrected MLE) | 1.492 |
| Theta hat (MLE) | 2.9224E-4 | Theta star (bias corrected MLE) | 3.2333E-4 |
| nu hat (MLE) | 89.11 | nu star (bias corrected) | 80.54 |
| Mean (detects) | 4.8226E-4 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 7.7000E-5 | Mean | 0.00476 |
| Maximum | 0.01 | Median | 0.0014 |
| SD | 0.00479 | CV | 1.008 |
| k hat (MLE) | 0.562 | k star (bias corrected MLE) | 0.541 |
| Theta hat (MLE) | 0.00846 | Theta star (bias corrected MLE) | 0.00879 |
| nu hat (MLE) | 55.06 | nu star (bias corrected) | 53.02 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (53.02, α) | 37.29 | Adjusted Chi Square Value (53.02, β) | 36.89 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00676 | 95% Gamma Adjusted UCL (use when n<50) | 0.00683 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 3.6613E-4 | SD (KM) | 3.6123E-4 |
| Variance (KM) | 1.3048E-7 | SE of Mean (KM) | 5.6497E-5 |
| k hat (KM) | 1.027 | k star (KM) | 0.978 |
| nu hat (KM) | 100.7 | nu star (KM) | 95.85 |
| theta hat (KM) | 3.5639E-4 | theta star (KM) | 3.7435E-4 |
| 80% gamma percentile (KM) | 5.9031E-4 | 90% gamma percentile (KM) | 8.4767E-4 |
| 95% gamma percentile (KM) | 0.00111 | 99% gamma percentile (KM) | 0.00171 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (95.85, α) | 74.27 | Adjusted Chi Square Value (95.85, β) | 73.69 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 4.7253E-4 | 95% Gamma Adjusted KM-UCL (use when n<50) | 4.7622E-4 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.124 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.167 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 3.4898E-4 | Mean in Log Scale | -8.328 |
| SD in Original Scale | 3.5531E-4 | SD in Log Scale | 0.84 |
| 95% t UCL (assumes normality of ROS data) | 4.3412E-4 | 95% Percentile Bootstrap UCL | 4.3572E-4 |
| 95% BCA Bootstrap UCL | 4.5784E-4 | 95% Bootstrap t UCL | 4.5871E-4 |
| 95% H-UCL (Log ROS) | 4.4778E-4 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -8.31 | KM Geo Mean | 2.4593E-4 |
| KM SD (logged) | 0.885 | 95% Critical H Value (KM-Log) | 2.22 |
| KM Standard Error of Mean (logged) | 0.151 | 95% H-UCL (KM -Log) | 4.8326E-4 |
| KM SD (logged) | 0.885 | 95% Critical H Value (KM-Log) | 2.22 |
| KM Standard Error of Mean (logged) | 0.151 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 4.4106E-4 | Mean in Log Scale | -8.075 |
| SD in Original Scale | 3.4951E-4 | SD in Log Scale | 0.944 |
| 95% t UCL (Assumes normality) | 5.2481E-4 | 95% H-Stat UCL | 6.6294E-4 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 4.7622E-4 | 95% GROS Adjusted Gamma UCL | 0.00683 |

**Warning: Recommended UCL exceeds the maximum observation**

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_PestPCBs|Heptachlor

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 37 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 30 | Number of Non-Detects | 19 |
| Number of Distinct Detects | 26 | Number of Distinct Non-Detects | 14 |
| Minimum Detect | 2.1000E-4 | Minimum Non-Detect | 3.4000E-5 |
| Maximum Detect | 0.0071 | Maximum Non-Detect | 0.0013 |
| Variance Detects | 2.4635E-6 | Percent Non-Detects | 38.78% |
| Mean Detects | 0.00153 | SD Detects | 0.00157 |
| Median Detects | 9.3000E-4 | CV Detects | 1.024 |
| Skewness Detects | 2.105 | Kurtosis Detects | 4.66 |
| Mean of Logged Detects | -6.861 | SD of Logged Detects | 0.858 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.727 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.275 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.00108 | KM Standard Error of Mean | 1.9864E-4 |
| KM SD | 0.00135 | 95% KM (BCA) UCL | 0.00146 |
| 95% KM (t) UCL | 0.00141 | 95% KM (Percentile Bootstrap) UCL | 0.00143 |
| 95% KM (z) UCL | 0.00141 | 95% KM Bootstrap t UCL | 0.00155 |
| 90% KM Chebyshev UCL | 0.00168 | 95% KM Chebyshev UCL | 0.00195 |
| 97.5% KM Chebyshev UCL | 0.00232 | 99% KM Chebyshev UCL | 0.00306 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 1.28 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.764 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.21 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.163 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.458 | k star (bias corrected MLE) | 1.334 |
| Theta hat (MLE) | 0.00105 | Theta star (bias corrected MLE) | 0.00115 |
| nu hat (MLE) | 87.48 | nu star (bias corrected) | 80.06 |
| Mean (detects) | 0.00153 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 2.1000E-4 | Mean | 0.00482 |
| Maximum | 0.01 | Median | 0.0032 |
| SD | 0.00434 | CV | 0.902 |
| k hat (MLE) | 0.899 | k star (bias corrected MLE) | 0.857 |
| Theta hat (MLE) | 0.00536 | Theta star (bias corrected MLE) | 0.00562 |
| nu hat (MLE) | 88.06 | nu star (bias corrected) | 84 |
| Adjusted Level of Significance (β) | 0.0451 | | |
| Approximate Chi Square Value (84.00, α) | 63.88 | Adjusted Chi Square Value (84.00, β) | 63.35 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.00633 | 95% Gamma Adjusted UCL (use when n<50) | 0.00639 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00108 | SD (KM) | 0.00135 |
| Variance (KM) | 1.8248E-6 | SE of Mean (KM) | 1.9864E-4 |
| k hat (KM) | 0.64 | k star (KM) | 0.614 |
| nu hat (KM) | 62.69 | nu star (KM) | 60.19 |
| theta hat (KM) | 0.00169 | theta star (KM) | 0.00176 |
| 80% gamma percentile (KM) | 0.00178 | 90% gamma percentile (KM) | 0.0028 |
| 95% gamma percentile (KM) | 0.00386 | 99% gamma percentile (KM) | 0.00641 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (60.19, α) | 43.35 | Adjusted Chi Square Value (60.19, β) | 42.91 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0015 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.00152 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.954 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.927 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.155 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.159 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00109 | Mean in Log Scale | -7.306 |
| SD in Original Scale | 0.00135 | SD in Log Scale | 0.94 |
| 95% t UCL (assumes normality of ROS data) | 0.00141 | 95% Percentile Bootstrap UCL | 0.00142 |
| 95% BCA Bootstrap UCL | 0.00149 | 95% Bootstrap t UCL | 0.00155 |
| 95% H-UCL (Log ROS) | 0.00142 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -7.574 | KM Geo Mean | 5.1365E-4 |
| KM SD (logged) | 1.43 | 95% Critical H Value (KM-Log) | 2.845 |
| KM Standard Error of Mean (logged) | 0.242 | 95% H-UCL (KM -Log) | 0.00257 |
| KM SD (logged) | 1.43 | 95% Critical H Value (KM-Log) | 2.845 |
| KM Standard Error of Mean (logged) | 0.242 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00109 | Mean in Log Scale | -7.426 |
| SD in Original Scale | 0.00135 | SD in Log Scale | 1.268 |
| 95% t UCL (Assumes normality) | 0.00141 | 95% H-Stat UCL | 0.00216 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

KM H-UCL 0.00257

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PCB, Congeners UG/KG

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 32 | Number of Distinct Observations | 23 |
| | | Number of Missing Observations | 0 |
| Minimum | 38 | Mean | 905.2 |
| Maximum | 11800 | Median | 238 |
| SD | 2118 | Std. Error of Mean | 374.5 |
| Coefficient of Variation | 2.34 | Skewness | 4.733 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.397 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.93 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.341 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.154 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 1540 | 95% Adjusted-CLT UCL (Chen-1995) | 1856 |
| | | 95% Modified-t UCL (Johnson-1978) | 1592 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 2.792 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.798 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.28 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.163 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.639 | k star (bias corrected MLE) | 0.6 |
| Theta hat (MLE) | 1416 | Theta star (bias corrected MLE) | 1508 |
| nu hat (MLE) | 40.92 | nu star (bias corrected) | 38.41 |
| MLE Mean (bias corrected) | 905.2 | MLE Sd (bias corrected) | 1168 |
| | | Approximate Chi Square Value (0.05) | 25.22 |
| Adjusted Level of Significance | 0.0416 | Adjusted Chi Square Value | 24.65 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1379 | 95% Adjusted Gamma UCL (use when n<50) | 1411 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.911 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.93 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.214 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.154 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.638 | Mean of logged Data | 5.851 |
| Maximum of Logged Data | 9.376 | SD of logged Data | 1.207 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1291 | 90% Chebyshev (MVUE) UCL | 1229 |
| 95% Chebyshev (MVUE) UCL | 1471 | 97.5% Chebyshev (MVUE) UCL | 1808 |
| 99% Chebyshev (MVUE) UCL | 2468 | | |

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution (0.05)

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1521 | 95% Jackknife UCL | 1540 |
| 95% Standard Bootstrap UCL | 1504 | 95% Bootstrap-t UCL | 3371 |
| 95% Hall's Bootstrap UCL | 3883 | 95% Percentile Bootstrap UCL | 1568 |
| 95% BCA Bootstrap UCL | 1976 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2029 | 95% Chebyshev(Mean, Sd) UCL | 2538 |
| 97.5% Chebyshev(Mean, Sd) UCL | 3244 | 99% Chebyshev(Mean, Sd) UCL | 4631 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Chebyshev (Mean, Sd) UCL | 2538 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

RA18_SE_DioxinFurans|1,2,3,7,8,9-Hexachlorodibenzofuran

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 41 | Number of Distinct Observations | 41 |
| | | Number of Missing Observations | 44 |
| Number of Detects | 27 | Number of Non-Detects | 14 |
| Number of Distinct Detects | 27 | Number of Distinct Non-Detects | 14 |
| Minimum Detect | 5.83E-08 | Minimum Non-Detect | 1.4800E-8 |
| Maximum Detect | 2.43E-05 | Maximum Non-Detect | 6.3000E-7 |
| Variance Detects | 2.680E-11 | Percent Non-Detects | 34.15% |
| Mean Detects | 2.21E-06 | SD Detects | 5.1774E-6 |
| Median Detects | 3.8500E-7 | CV Detects | N/A |
| Skewness Detects | 3.586 | Kurtosis Detects | 13.64 |
| Mean of Logged Detects | -14.51 | SD of Logged Detects | 1.631 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.461 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.356 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.167 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 1.47E-06 | KM Standard Error of Mean | 6.7603E-7 |
| KM SD | 4.2476E-6 | 95% KM (BCA) UCL | 2.8932E-6 |
| 95% KM (t) UCL | 2.6118E-6 | 95% KM (Percentile Bootstrap) UCL | 2.6853E-6 |
| 95% KM (z) UCL | 2.5854E-6 | 95% KM Bootstrap t UCL | 5.2315E-6 |
| 90% KM Chebyshev UCL | 3.5015E-6 | 95% KM Chebyshev UCL | 4.4202E-6 |
| 97.5% KM Chebyshev UCL | 5.6952E-6 | 99% KM Chebyshev UCL | 8.1998E-6 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 1.978 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.822 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.218 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.179 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.437 | k star (bias corrected MLE) | 0.414 |
| Theta hat (MLE) | 5.0493E-6 | Theta star (bias corrected MLE) | 5.3412E-6 |
| nu hat (MLE) | 23.62 | nu star (bias corrected) | 22.33 |
| Mean (detects) | 2.2086E-6 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 5.8300E-8 | Mean | 0.00342 |
| Maximum | 0.01 | Median | 1.1900E-6 |
| SD | 0.0048 | CV | 1.405 |
| k hat (MLE) | 0.142 | k star (bias corrected MLE) | 0.148 |
| Theta hat (MLE) | 0.024 | Theta star (bias corrected MLE) | 0.0231 |
| nu hat (MLE) | 11.66 | nu star (bias corrected) | 12.14 |
| Adjusted Level of Significance (β) | 0.0441 | | |
| Approximate Chi Square Value (12.14, α) | 5.32 | Adjusted Chi Square Value (12.14, β) | 5.156 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0078 | 95% Gamma Adjusted UCL (use when n<50) | 0.00805 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 1.4734E-6 | SD (KM) | 4.2476E-6 |
| Variance (KM) | 1.804E-11 | SE of Mean (KM) | 6.7603E-7 |
| k hat (KM) | 0.12 | k star (KM) | 0.128 |
| nu hat (KM) | 9.867 | nu star (KM) | 10.48 |
| theta hat (KM) | 1.2245E-5 | theta star (KM) | 1.1530E-5 |
| 80% gamma percentile (KM) | 1.3832E-6 | 90% gamma percentile (KM) | 4.2419E-6 |
| 95% gamma percentile (KM) | 8.3358E-6 | 99% gamma percentile (KM) | 2.0642E-5 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (10.48, α) | 4.243 | Adjusted Chi Square Value (10.48, β) | 4.098 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 3.6388E-6 | 95% Gamma Adjusted KM-UCL (use when n<50) | 3.7672E-6 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.936 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.115 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.167 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.4659E-6 | Mean in Log Scale | -15.52 |
| SD in Original Scale | 4.3028E-6 | SD in Log Scale | 1.989 |
| 95% t UCL (assumes normality of ROS data) | 2.5974E-6 | 95% Percentile Bootstrap UCL | 2.7329E-6 |
| 95% BCA Bootstrap UCL | 3.2796E-6 | 95% Bootstrap t UCL | 5.3323E-6 |
| 95% H-UCL (Log ROS) | 4.1102E-6 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -15.43 | KM Geo Mean | 1.9826E-7 |
| KM SD (logged) | 1.915 | 95% Critical H Value (KM-Log) | 3.52 |
| KM Standard Error of Mean (logged) | 0.32 | 95% H-UCL (KM -Log) | 3.5980E-6 |
| KM SD (logged) | 1.915 | 95% Critical H Value (KM-Log) | 3.52 |
| KM Standard Error of Mean (logged) | 0.32 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.4842E-6 | Mean in Log Scale | -15.27 |
| SD in Original Scale | 4.2969E-6 | SD in Log Scale | 1.813 |
| 95% t UCL (Assumes normality) | 2.6141E-6 | 95% H-Stat UCL | 3.1683E-6 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Lognormal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (Chebyshev) UCL 4.42E-06

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

### UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.14/30/2019 9:42:49 AM |
| From File | ERA_FWM_ProUCL_Input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

#### Arsenic

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 26 |
| | | Number of Missing Observations | 21 |
| Number of Detects | 16 | Number of Non-Detects | 12 |
| Number of Distinct Detects | 15 | Number of Distinct Non-Detects | 12 |
| Minimum Detect | 0.029 | Minimum Non-Detect | 0.018 |
| Maximum Detect | 0.38 | Maximum Non-Detect | 0.25 |
| Variance Detects | 0.00895 | Percent Non-Detects | 42.86% |
| Mean Detects | 0.148 | SD Detects | 0.0946 |
| Median Detects | 0.12 | CV Detects | 0.641 |
| Skewness Detects | 1.05 | Kurtosis Detects | 0.816 |
| Mean of Logged Detects | -2.112 | SD of Logged Detects | 0.676 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.911 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.199 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.107 | KM Standard Error of Mean | 0.018 |
| KM SD | 0.088 | 95% KM (BCA) UCL | 0.139 |
| 95% KM (t) UCL | 0.138 | 95% KM (Percentile Bootstrap) UCL | 0.138 |
| 95% KM (z) UCL | 0.137 | 95% KM Bootstrap t UCL | 0.145 |
| 90% KM Chebyshev UCL | 0.161 | 95% KM Chebyshev UCL | 0.186 |
| 97.5% KM Chebyshev UCL | 0.22 | 99% KM Chebyshev UCL | 0.287 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.222 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.746 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.123 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.217 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.664 | k star (bias corrected MLE) | 2.206 |
| Theta hat (MLE) | 0.0554 | Theta star (bias corrected MLE) | 0.0669 |
| nu hat (MLE) | 85.24 | nu star (bias corrected) | 70.59 |
| Mean (detects) | 0.148 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.103 |
| Maximum | 0.38 | Median | 0.0696 |
| SD | 0.0893 | CV | 0.865 |
| k hat (MLE) | 1.406 | k star (bias corrected MLE) | 1.279 |
| Theta hat (MLE) | 0.0734 | Theta star (bias corrected MLE) | 0.0807 |
| nu hat (MLE) | 78.73 | nu star (bias corrected) | 71.63 |
| Adjusted Level of Significance (β) | 0.0404 | | |
| Approximate Chi Square Value (71.63, α) | 53.14 | Adjusted Chi Square Value (71.63, β) | 52.16 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.139 | 95% Gamma Adjusted UCL (use when n<50) | 0.142 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.107 | SD (KM) | 0.088 |
| Variance (KM) | 0.00774 | SE of Mean (KM) | 0.018 |
| k hat (KM) | 1.49 | k star (KM) | 1.354 |
| nu hat (KM) | 83.41 | nu star (KM) | 75.81 |
| theta hat (KM) | 0.0721 | theta star (KM) | 0.0793 |
| 80% gamma percentile (KM) | 0.168 | 90% gamma percentile (KM) | 0.229 |
| 95% gamma percentile (KM) | 0.29 | 99% gamma percentile (KM) | 0.426 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (75.81, α) | 56.76 | Adjusted Chi Square Value (75.81, β) | 55.74 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.143 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.146 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.98 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.107 | Mean in Log Scale | -2.499 |
| SD in Original Scale | 0.0861 | SD in Log Scale | 0.723 |
| 95% t UCL (assumes normality of ROS data) | 0.134 | 95% Percentile Bootstrap UCL | 0.134 |
| 95% BCA Bootstrap UCL | 0.139 | 95% Bootstrap t UCL | 0.142 |
| 95% H-UCL (Log ROS) | 0.144 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.585 | KM Geo Mean | 0.0754 |
| KM SD (logged) | 0.886 | 95% Critical H Value (KM-Log) | 2.32 |
| KM Standard Error of Mean (logged) | 0.199 | 95% H-UCL (KM -Log) | 0.166 |
| KM SD (logged) | 0.886 | 95% Critical H Value (KM-Log) | 2.32 |
| KM Standard Error of Mean (logged) | 0.199 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.111 | Mean in Log Scale | -2.512 |
| SD in Original Scale | 0.0861 | SD in Log Scale | 0.886 |
| 95% t UCL (Assumes normality) | 0.139 | 95% H-Stat UCL | 0.178 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.138

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

Cadmium

General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 16 |
| | | Number of Missing Observations | 21 |
| Number of Detects | 10 | Number of Non-Detects | 18 |
| Number of Distinct Detects | 9 | Number of Distinct Non-Detects | 8 |
| Minimum Detect | 0.0074 | Minimum Non-Detect | 0.0068 |
| Maximum Detect | 0.027 | Maximum Non-Detect | 0.016 |
| Variance Detects | 3.5100E-5 | Percent Non-Detects | 64.29% |
| Mean Detects | 0.0168 | SD Detects | 0.00592 |
| Median Detects | 0.016 | CV Detects | 0.352 |
| Skewness Detects | 0.153 | Kurtosis Detects | -0.518 |
| Mean of Logged Detects | -4.146 | SD of Logged Detects | 0.384 |

Normal GOF Test on Detects Only

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.982 | Shapiro Wilk GOF Test | |
| 5% Shapiro Wilk Critical Value | 0.842 | Detected Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.122 | Lilliefors GOF Test | |
| 5% Lilliefors Critical Value | 0.262 | Detected Data appear Normal at 5% Significance Level | |

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.0104 | KM Standard Error of Mean | 0.00117 |
| KM SD | 0.00586 | 95% KM (BCA) UCL | 0.0124 |
| 95% KM (t) UCL | 0.0124 | 95% KM (Percentile Bootstrap) UCL | 0.0123 |
| 95% KM (z) UCL | 0.0124 | 95% KM Bootstrap t UCL | 0.0127 |
| 90% KM Chebyshev UCL | 0.014 | 95% KM Chebyshev UCL | 0.0156 |
| 97.5% KM Chebyshev UCL | 0.0178 | 99% KM Chebyshev UCL | 0.0221 |

Gamma GOF Tests on Detected Observations Only

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.175 | Anderson-Darling GOF Test | |
| 5% A-D Critical Value | 0.727 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.133 | Kolmogorov-Smirnov GOF | |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level | |

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 8.237 | k star (bias corrected MLE) | 5.833 |
| Theta hat (MLE) | 0.00204 | Theta star (bias corrected MLE) | 0.00289 |
| nu hat (MLE) | 164.7 | nu star (bias corrected) | 116.7 |
| Mean (detects) | 0.0168 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0074 | Mean | 0.0124 |
| Maximum | 0.027 | Median | 0.01 |
| SD | 0.00478 | CV | 0.384 |
| k hat (MLE) | 9.33 | k star (bias corrected MLE) | 8.354 |
| Theta hat (MLE) | 0.00133 | Theta star (bias corrected MLE) | 0.00149 |
| nu hat (MLE) | 522.5 | nu star (bias corrected) | 467.8 |
| Adjusted Level of Significance (β) | 0.0404 | | |
| Approximate Chi Square Value (467.84, α) | 418.7 | Adjusted Chi Square Value (467.84, β) | 415.8 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0139 | 95% Gamma Adjusted UCL (use when n<50) | 0.014 |

Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0104 | SD (KM) | 0.00586 |
| Variance (KM) | 3.4345E-5 | SE of Mean (KM) | 0.00117 |
| k hat (KM) | 3.174 | k star (KM) | 2.858 |
| nu hat (KM) | 177.8 | nu star (KM) | 160.1 |
| theta hat (KM) | 0.00329 | theta star (KM) | 0.00365 |
| 80% gamma percentile (KM) | 0.015 | 90% gamma percentile (KM) | 0.0187 |
| 95% gamma percentile (KM) | 0.0222 | 99% gamma percentile (KM) | 0.0298 |

Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (160.06, α) | 131.8 | Adjusted Chi Square Value (160.06, β) | 130.2 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0127 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0128 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.965 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.129 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Detected Data appear Lognormal at 5% Significance Level | |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00947 | Mean in Log Scale | -4.868 |
| SD in Original Scale | 0.00667 | SD in Log Scale | 0.642 |
| 95% t UCL (assumes normality of ROS data) | 0.0116 | 95% Percentile Bootstrap UCL | 0.0116 |
| 95% BCA Bootstrap UCL | 0.0118 | 95% Bootstrap t UCL | 0.0121 |
| 95% H-UCL (Log ROS) | 0.0122 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -4.683 | KM Geo Mean | 0.00925 |
| KM SD (logged) | 0.46 | 95% Critical H Value (KM-Log) | 1.91 |
| KM Standard Error of Mean (logged) | 0.0922 | 95% H-UCL (KM -Log) | 0.0122 |
| KM SD (logged) | 0.46 | 95% Critical H Value (KM-Log) | 1.91 |
| KM Standard Error of Mean (logged) | 0.0922 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00859 | Mean in Log Scale | -5.051 |
| SD in Original Scale | 0.0072 | SD in Log Scale | 0.749 |
| 95% t UCL (Assumes normality) | 0.0109 | 95% H-Stat UCL | 0.0116 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Normal Distributed at 5% Significance Level**

**Suggested UCL to Use**

95% KM (t) UCL 0.0124

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Fish Tissue**

**Chromium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 19 |
| | | Number of Missing Observations | 21 |
| Minimum | 0.29 | Mean | 1.144 |
| Maximum | 2.1 | Median | 1.1 |
| SD | 0.468 | Std. Error of Mean | 0.0884 |
| Coefficient of Variation | 0.409 | Skewness | 0.458 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.96 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.145 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.295 | 95% Adjusted-CLT UCL (Chen-1995) | 1.298 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.296 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.217 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.748 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0897 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.166 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.755 | k star (bias corrected MLE) | 5.163 |
| Theta hat (MLE) | 0.199 | Theta star (bias corrected MLE) | 0.222 |
| nu hat (MLE) | 322.3 | nu star (bias corrected) | 289.1 |
| MLE Mean (bias corrected) | 1.144 | MLE Sd (bias corrected) | 0.504 |
| | | Approximate Chi Square Value (0.05) | 250.7 |
| Adjusted Level of Significance | 0.0404 | Adjusted Chi Square Value | 248.5 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.319 | 95% Adjusted Gamma UCL (use when n<50) | 1.331 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.958 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.115 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.238 | Mean of logged Data | 0.0454 |
| Maximum of Logged Data | 0.742 | SD of logged Data | 0.451 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.367 | 90% Chebyshev (MVUE) UCL | 1.46 |
| 95% Chebyshev (MVUE) UCL | 1.599 | 97.5% Chebyshev (MVUE) UCL | 1.791 |
| 99% Chebyshev (MVUE) UCL | 2.169 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.29 | 95% Jackknife UCL | 1.295 |
| 95% Standard Bootstrap UCL | 1.287 | 95% Bootstrap-t UCL | 1.303 |
| 95% Hall's Bootstrap UCL | 1.296 | 95% Percentile Bootstrap UCL | 1.286 |
| 95% BCA Bootstrap UCL | 1.295 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.409 | 95% Chebyshev(Mean, Sd) UCL | 1.53 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.696 | 99% Chebyshev(Mean, Sd) UCL | 2.024 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 1.295 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Fish Tissue

### Copper

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 28 | Number of Distinct Observations | 19 |
| | | Number of Missing Observations | 21 |
| Minimum | 0.49 | Mean | 0.949 |
| Maximum | 2 | Median | 0.82 |
| SD | 0.428 | Std. Error of Mean | 0.0808 |
| Coefficient of Variation | 0.451 | Skewness | 0.881 |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.878 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.924 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.2 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.164 | Data Not Normal at 5% Significance Level | |
| Data Not Normal at 5% Significance Level | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.087 | 95% Adjusted-CLT UCL (Chen-1995) | 1.096 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.089 |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.975 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.748 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.19 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.166 | Data Not Gamma Distributed at 5% Significance Level | |
| Data Not Gamma Distributed at 5% Significance Level | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 5.57 | k star (bias corrected MLE) | 4.997 |
| Theta hat (MLE) | 0.17 | Theta star (bias corrected MLE) | 0.19 |
| nu hat (MLE) | 311.9 | nu star (bias corrected) | 279.8 |
| MLE Mean (bias corrected) | 0.949 | MLE Sd (bias corrected) | 0.425 |
| | | Approximate Chi Square Value (0.05) | 242.1 |
| Adjusted Level of Significance | 0.0404 | Adjusted Chi Square Value | 239.9 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 1.097 | 95% Adjusted Gamma UCL (use when n<50) | 1.107 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.913 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.924 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.175 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.164 | Data Not Lognormal at 5% Significance Level | |
| Data Not Lognormal at 5% Significance Level | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | -0.713 | Mean of logged Data | -0.145 |
| Maximum of Logged Data | 0.693 | SD of logged Data | 0.434 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 1.113 | 90% Chebyshev (MVUE) UCL | 1.188 |
| 95% Chebyshev (MVUE) UCL | 1.297 | 97.5% Chebyshev (MVUE) UCL | 1.448 |
| 99% Chebyshev (MVUE) UCL | 1.745 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| Data do not follow a Discernible Distribution (0.05) | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 1.082 | 95% Jackknife UCL | 1.087 |
| 95% Standard Bootstrap UCL | 1.08 | 95% Bootstrap-t UCL | 1.103 |
| 95% Hall's Bootstrap UCL | 1.101 | 95% Percentile Bootstrap UCL | 1.085 |
| 95% BCA Bootstrap UCL | 1.096 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.192 | 95% Chebyshev(Mean, Sd) UCL | 1.301 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.454 | 99% Chebyshev(Mean, Sd) UCL | 1.753 |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 1.087 | or 95% Modified-t UCL | 1.089 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 23 |
| | | Number of Missing Observations | 21 |
| Number of Detects | 27 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 23 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.059 | Minimum Non-Detect | 0.13 |
| Maximum Detect | 1.5 | Maximum Non-Detect | 0.13 |
| Variance Detects | 0.171 | Percent Non-Detects | 3.571% |
| Mean Detects | 0.523 | SD Detects | 0.414 |
| Median Detects | 0.35 | CV Detects | 0.791 |
| Skewness Detects | 1.062 | Kurtosis Detects | 0.294 |
| Mean of Logged Detects | -0.963 | SD of Logged Detects | 0.838 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.859 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.181 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.167 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.507 | KM Standard Error of Mean | 0.0786 |
| KM SD | 0.408 | 95% KM (BCA) UCL | 0.634 |
| 95% KM (t) UCL | 0.641 | 95% KM (Percentile Bootstrap) UCL | 0.638 |
| 95% KM (z) UCL | 0.636 | 95% KM Bootstrap t UCL | 0.673 |
| 90% KM Chebyshev UCL | 0.742 | 95% KM Chebyshev UCL | 0.849 |
| 97.5% KM Chebyshev UCL | 0.997 | 99% KM Chebyshev UCL | 1.288 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.615 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.76 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.16 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.171 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.733 | k star (bias corrected MLE) | 1.565 |
| Theta hat (MLE) | 0.302 | Theta star (bias corrected MLE) | 0.334 |
| nu hat (MLE) | 93.6 | nu star (bias corrected) | 84.53 |
| Mean (detects) | 0.523 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.505 |
| Maximum | 1.5 | Median | 0.335 |
| SD | 0.417 | CV | 0.827 |
| k hat (MLE) | 1.363 | k star (bias corrected MLE) | 1.24 |
| Theta hat (MLE) | 0.371 | Theta star (bias corrected MLE) | 0.407 |
| nu hat (MLE) | 76.31 | nu star (bias corrected) | 69.47 |
| Adjusted Level of Significance (β) | 0.0404 | | |
| Approximate Chi Square Value (69.47, α) | 51.28 | Adjusted Chi Square Value (69.47, β) | 50.31 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.684 | 95% Gamma Adjusted UCL (use when n<50) | 0.697 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.507 | SD (KM) | 0.408 |
| Variance (KM) | 0.166 | SE of Mean (KM) | 0.0786 |
| k hat (KM) | 1.543 | k star (KM) | 1.401 |
| nu hat (KM) | 86.4 | nu star (KM) | 78.47 |
| theta hat (KM) | 0.328 | theta star (KM) | 0.362 |
| 80% gamma percentile (KM) | 0.79 | 90% gamma percentile (KM) | 1.074 |
| 95% gamma percentile (KM) | 1.351 | 99% gamma percentile (KM) | 1.979 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (78.47, α) | 59.07 | Adjusted Chi Square Value (78.47, β) | 58.02 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.673 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.685 |

| Lognormal GOF Test on Detected Observations Only | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.958 | Shapiro Wilk GOF Test | |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.135 | Lilliefors GOF Test | |
| 5% Lilliefors Critical Value | 0.167 | Detected Data appear Lognormal at 5% Significance Level | |
| Detected Data appear Lognormal at 5% Significance Level | | | |

| Lognormal ROS Statistics Using Imputed Non-Detects | | | |
|---|---|---|---|
| Mean in Original Scale | 0.507 | Mean in Log Scale | -1.026 |
| SD in Original Scale | 0.415 | SD in Log Scale | 0.886 |
| 95% t UCL (assumes normality of ROS data) | 0.641 | 95% Percentile Bootstrap UCL | 0.641 |
| 95% BCA Bootstrap UCL | 0.647 | 95% Bootstrap t UCL | 0.658 |
| 95% H-UCL (Log ROS) | 0.789 | | |

| Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution | | | |
|---|---|---|---|
| KM Mean (logged) | -1.03 | KM Geo Mean | 0.357 |
| KM SD (logged) | 0.879 | 95% Critical H Value (KM-Log) | 2.312 |
| KM Standard Error of Mean (logged) | 0.169 | 95% H-UCL (KM -Log) | 0.777 |
| KM SD (logged) | 0.879 | 95% Critical H Value (KM-Log) | 2.312 |
| KM Standard Error of Mean (logged) | 0.169 | | |

| DL/2 Statistics | | | |
|---|---|---|---|
| DL/2 Normal | | DL/2 Log-Transformed | |
| Mean in Original Scale | 0.507 | Mean in Log Scale | -1.026 |
| SD in Original Scale | 0.415 | SD in Log Scale | 0.888 |
| 95% t UCL (Assumes normality) | 0.641 | 95% H-Stat UCL | 0.79 |
| DL/2 is not a recommended method, provided for comparisons and historical reasons | | | |

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

| Suggested UCL to Use | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 0.685 | 95% GROS Adjusted Gamma UCL | 0.697 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

Mercury

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 22 |
| | | Number of Missing Observations | 20 |
| Number of Detects | 9 | Number of Non-Detects | 20 |
| Number of Distinct Detects | 7 | Number of Distinct Non-Detects | 16 |
| Minimum Detect | 0.019 | Minimum Non-Detect | 0.011 |
| Maximum Detect | 0.086 | Maximum Non-Detect | 0.056 |
| Variance Detects | 5.7036E-4 | Percent Non-Detects | 68.97% |
| Mean Detects | 0.0529 | SD Detects | 0.0239 |
| Median Detects | 0.05 | CV Detects | 0.452 |
| Skewness Detects | -0.245 | Kurtosis Detects | -1.003 |
| Mean of Logged Detects | -3.06 | SD of Logged Detects | 0.562 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.829 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.148 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.274 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.0288 | KM Standard Error of Mean | 0.00499 |
| KM SD | 0.0223 | 95% KM (BCA) UCL | 0.0382 |
| 95% KM (t) UCL | 0.0373 | 95% KM (Percentile Bootstrap) UCL | 0.038 |
| 95% KM (z) UCL | 0.037 | 95% KM Bootstrap t UCL | 0.0375 |
| 90% KM Chebyshev UCL | 0.0438 | 95% KM Chebyshev UCL | 0.0506 |
| 97.5% KM Chebyshev UCL | 0.06 | 99% KM Chebyshev UCL | 0.0784 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.49 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.724 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.213 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.28 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.326 | k star (bias corrected MLE) | 2.958 |
| Theta hat (MLE) | 0.0122 | Theta star (bias corrected MLE) | 0.0179 |
| nu hat (MLE) | 77.88 | nu star (bias corrected) | 53.25 |
| Mean (detects) | 0.0529 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.0266 |
| Maximum | 0.086 | Median | 0.017 |
| SD | 0.0225 | CV | 0.845 |
| k hat (MLE) | 1.986 | k star (bias corrected MLE) | 1.804 |
| Theta hat (MLE) | 0.0134 | Theta star (bias corrected MLE) | 0.0148 |
| nu hat (MLE) | 115.2 | nu star (bias corrected) | 104.6 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (104.62, α) | 82.01 | Adjusted Chi Square Value (104.62, β) | 80.82 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.034 | 95% Gamma Adjusted UCL (use when n<50) | 0.0345 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0288 | SD (KM) | 0.0223 |
| Variance (KM) | 4.9523E-4 | SE of Mean (KM) | 0.00499 |
| k hat (KM) | 1.678 | k star (KM) | 1.527 |
| nu hat (KM) | 97.3 | nu star (KM) | 88.56 |
| theta hat (KM) | 0.0172 | theta star (KM) | 0.0189 |
| 80% gamma percentile (KM) | 0.0445 | 90% gamma percentile (KM) | 0.0598 |
| 95% gamma percentile (KM) | 0.0746 | 99% gamma percentile (KM) | 0.108 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (88.56, α) | 67.87 | Adjusted Chi Square Value (88.56, β) | 66.79 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.0376 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0382 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.853 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.829 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.248 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.274 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0282 | Mean in Log Scale | -3.782 |
| SD in Original Scale | 0.0215 | SD in Log Scale | 0.618 |
| 95% t UCL (assumes normality of ROS data) | 0.0349 | 95% Percentile Bootstrap UCL | 0.0345 |
| 95% BCA Bootstrap UCL | 0.036 | 95% Bootstrap t UCL | 0.0364 |
| 95% H-UCL (Log ROS) | 0.035 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.803 | KM Geo Mean | 0.0223 |
| KM SD (logged) | 0.69 | 95% Critical H Value (KM-Log) | 2.119 |
| KM Standard Error of Mean (logged) | 0.178 | 95% H-UCL (KM -Log) | 0.0373 |
| KM SD (logged) | 0.69 | 95% Critical H Value (KM-Log) | 2.119 |
| KM Standard Error of Mean (logged) | 0.178 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0315 | Mean in Log Scale | -3.634 |
| SD in Original Scale | 0.0201 | SD in Log Scale | 0.615 |
| 95% t UCL (Assumes normality) | 0.0378 | 95% H-Stat UCL | 0.0405 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Normal Distributed at 5% Significance Level**

**Suggested UCL to Use**

95% KM (t) UCL 0.0373

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Fish Tissue

### Nickel

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 24 |
| | | Number of Missing Observations | 21 |
| Minimum | 0.12 | Mean | 0.501 |
| Maximum | 1.2 | Median | 0.415 |
| SD | 0.309 | Std. Error of Mean | 0.0585 |
| Coefficient of Variation | 0.617 | Skewness | 0.823 |

| Normal GOF Test | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.903 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.924 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.173 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.164 | Data Not Normal at 5% Significance Level | |

Data Not Normal at 5% Significance Level

| Assuming Normal Distribution | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.601 | 95% Adjusted-CLT UCL (Chen-1995) | 0.607 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.602 |

| Gamma GOF Test | | | |
|---|---|---|---|
| A-D Test Statistic | 0.398 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.755 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.131 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.167 | Detected data appear Gamma Distributed at 5% Significance Level | |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 2.753 | k star (bias corrected MLE) | 2.481 |
| Theta hat (MLE) | 0.182 | Theta star (bias corrected MLE) | 0.202 |
| nu hat (MLE) | 154.1 | nu star (bias corrected) | 139 |
| MLE Mean (bias corrected) | 0.501 | MLE Sd (bias corrected) | 0.318 |
| | | Approximate Chi Square Value (0.05) | 112.7 |
| Adjusted Level of Significance | 0.0404 | Adjusted Chi Square Value | 111.3 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.618 | 95% Adjusted Gamma UCL (use when n<50) | 0.626 |

| Lognormal GOF Test | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.961 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.12 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.164 | Data appear Lognormal at 5% Significance Level | |

Data appear Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -2.12 | Mean of logged Data | -0.884 |
| Maximum of Logged Data | 0.182 | SD of logged Data | 0.649 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 0.661 | 90% Chebyshev (MVUE) UCL | 0.705 |
| 95% Chebyshev (MVUE) UCL | 0.795 | 97.5% Chebyshev (MVUE) UCL | 0.92 |
| 99% Chebyshev (MVUE) UCL | 1.166 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 0.597 | 95% Jackknife UCL | 0.601 |
| 95% Standard Bootstrap UCL | 0.594 | 95% Bootstrap-t UCL | 0.61 |
| 95% Hall's Bootstrap UCL | 0.602 | 95% Percentile Bootstrap UCL | 0.595 |
| 95% BCA Bootstrap UCL | 0.605 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.676 | 95% Chebyshev(Mean, Sd) UCL | 0.756 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.866 | 99% Chebyshev(Mean, Sd) UCL | 1.083 |

| Suggested UCL to Use | |
|---|---|
| 95% Adjusted Gamma UCL | 0.626 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

### Selenium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 17 |
| | | Number of Missing Observations | 21 |
| Number of Detects | 21 | Number of Non-Detects | 7 |
| Number of Distinct Detects | 14 | Number of Distinct Non-Detects | 6 |
| Minimum Detect | 0.29 | Minimum Non-Detect | 0.22 |
| Maximum Detect | 0.44 | Maximum Non-Detect | 0.35 |
| Variance Detects | 0.00219 | Percent Non-Detects | 25% |
| Mean Detects | 0.361 | SD Detects | 0.0468 |
| Median Detects | 0.36 | CV Detects | 0.13 |
| Skewness Detects | 0.167 | Kurtosis Detects | -1.057 |
| Mean of Logged Detects | -1.028 | SD of Logged Detects | 0.13 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.951 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0991 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.331 | KM Standard Error of Mean | 0.0134 |
| KM SD | 0.0675 | 95% KM (BCA) UCL | 0.356 |
| 95% KM (t) UCL | 0.354 | 95% KM (Percentile Bootstrap) UCL | 0.354 |
| 95% KM (z) UCL | 0.353 | 95% KM Bootstrap t UCL | 0.352 |
| 90% KM Chebyshev UCL | 0.371 | 95% KM Chebyshev UCL | 0.39 |
| 97.5% KM Chebyshev UCL | 0.415 | 99% KM Chebyshev UCL | 0.465 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.334 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.741 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.108 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.189 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 62.54 | k star (bias corrected MLE) | 53.64 |
| Theta hat (MLE) | 0.00577 | Theta star (bias corrected MLE) | 0.00673 |
| nu hat (MLE) | 2627 | nu star (bias corrected) | 2253 |
| Mean (detects) | 0.361 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.247 | Mean | 0.339 |
| Maximum | 0.44 | Median | 0.34 |
| SD | 0.0565 | CV | 0.167 |
| k hat (MLE) | 37.28 | k star (bias corrected MLE) | 33.31 |
| Theta hat (MLE) | 0.00909 | Theta star (bias corrected MLE) | 0.0102 |
| nu hat (MLE) | 2088 | nu star (bias corrected) | 1865 |
| Adjusted Level of Significance (β) | 0.0404 | | |
| Approximate Chi Square Value (N/A, α) | 1766 | Adjusted Chi Square Value (N/A, β) | 1760 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.358 | 95% Gamma Adjusted UCL (use when n<50) | 0.359 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.331 | SD (KM) | 0.0675 |
| Variance (KM) | 0.00456 | SE of Mean (KM) | 0.0134 |
| k hat (KM) | 24.04 | k star (KM) | 21.49 |
| nu hat (KM) | 1346 | nu star (KM) | 1203 |
| theta hat (KM) | 0.0138 | theta star (KM) | 0.0154 |
| 80% gamma percentile (KM) | 0.389 | 90% gamma percentile (KM) | 0.425 |
| 95% gamma percentile (KM) | 0.457 | 99% gamma percentile (KM) | 0.52 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (N/A, α) | 1124 | Adjusted Chi Square Value (N/A, β) | 1119 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.355 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.356 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.953 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.908 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.103 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.188 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.34 | Mean in Log Scale | -1.092 |
| SD in Original Scale | 0.0552 | SD in Log Scale | 0.162 |
| 95% t UCL (assumes normality of ROS data) | 0.358 | 95% Percentile Bootstrap UCL | 0.357 |
| 95% BCA Bootstrap UCL | 0.357 | 95% Bootstrap t UCL | 0.358 |
| 95% H-UCL (Log ROS) | 0.359 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -1.128 | KM Geo Mean | 0.324 |
| KM SD (logged) | 0.218 | 95% Critical H Value (KM-Log) | 1.758 |
| KM Standard Error of Mean (logged) | 0.0438 | 95% H-UCL (KM -Log) | 0.357 |
| KM SD (logged) | 0.218 | 95% Critical H Value (KM-Log) | 1.758 |
| KM Standard Error of Mean (logged) | 0.0438 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.306 | Mean in Log Scale | -1.265 |
| SD in Original Scale | 0.106 | SD in Log Scale | 0.442 |
| 95% t UCL (Assumes normality) | 0.34 | 95% H-Stat UCL | 0.366 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

| | |
|---|---|
| 95% KM (t) UCL | 0.354 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

Silver

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 21 |
| Number of Detects | 4 | Number of Non-Detects | 24 |
| Number of Distinct Detects | 4 | Number of Distinct Non-Detects | 6 |
| Minimum Detect | 0.005 | Minimum Non-Detect | 0.0038 |
| Maximum Detect | 0.0081 | Maximum Non-Detect | 0.0094 |
| Variance Detects | 1.9500E-6 | Percent Non-Detects | 85.71% |
| Mean Detects | 0.00605 | SD Detects | 0.0014 |
| Median Detects | 0.00555 | CV Detects | 0.231 |
| Skewness Detects | 1.748 | Kurtosis Detects | 3.217 |
| Mean of Logged Detects | -5.126 | SD of Logged Detects | 0.213 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.813 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.349 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.375 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.00414 | KM Standard Error of Mean | 2.0710E-4 |
| KM SD | 9.2732E-4 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 0.00449 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 0.00448 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 0.00476 | 95% KM Chebyshev UCL | 0.00504 |
| 97.5% KM Chebyshev UCL | 0.00543 | 99% KM Chebyshev UCL | 0.0062 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.502 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.657 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.348 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.394 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 27.92 | k star (bias corrected MLE) | 7.146 |
| Theta hat (MLE) | 2.1671E-4 | Theta star (bias corrected MLE) | 8.4661E-4 |
| nu hat (MLE) | 223.3 | nu star (bias corrected) | 57.17 |
| Mean (detects) | 0.00605 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.005 | Mean | 0.00944 |
| Maximum | 0.01 | Median | 0.01 |
| SD | 0.00148 | CV | 0.157 |
| k hat (MLE) | 30.88 | k star (bias corrected MLE) | 27.59 |
| Theta hat (MLE) | 3.0558E-4 | Theta star (bias corrected MLE) | 3.4195E-4 |
| nu hat (MLE) | 1729 | nu star (bias corrected) | 1545 |
| Adjusted Level of Significance (β) | 0.0404 | | |
| Approximate Chi Square Value (N/A, α) | 1455 | Adjusted Chi Square Value (N/A, β) | 1450 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.01 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.00414 | SD (KM) | 9.2732E-4 |
| Variance (KM) | 8.5993E-7 | SE of Mean (KM) | 2.0710E-4 |
| k hat (KM) | 19.93 | k star (KM) | 17.82 |
| nu hat (KM) | 1116 | nu star (KM) | 997.8 |
| theta hat (KM) | 2.0772E-4 | theta star (KM) | 2.3234E-4 |
| 80% gamma percentile (KM) | 0.00493 | 90% gamma percentile (KM) | 0.00544 |
| 95% gamma percentile (KM) | 0.00587 | 99% gamma percentile (KM) | 0.00676 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (997.79, α) | 925.5 | Adjusted Chi Square Value (997.79, β) | 921.2 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.00446 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.00448 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.849 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.327 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.375 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.00301 | Mean in Log Scale | -5.909 |
| SD in Original Scale | 0.00152 | SD in Log Scale | 0.447 |
| 95% t UCL (assumes normality of ROS data) | 0.0035 | 95% Percentile Bootstrap UCL | 0.00348 |
| 95% BCA Bootstrap UCL | 0.00361 | 95% Bootstrap t UCL | 0.00367 |
| 95% H-UCL (Log ROS) | 0.00353 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -5.505 | KM Geo Mean | 0.00407 |
| KM SD (logged) | 0.175 | 95% Critical H Value (KM-Log) | 1.737 |
| KM Standard Error of Mean (logged) | 0.0391 | 95% H-UCL (KM -Log) | 0.00438 |
| KM SD (logged) | 0.175 | 95% Critical H Value (KM-Log) | 1.737 |
| KM Standard Error of Mean (logged) | 0.0391 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.00268 | Mean in Log Scale | -6.029 |
| SD in Original Scale | 0.00158 | SD in Log Scale | 0.427 |
| 95% t UCL (Assumes normality) | 0.00319 | 95% H-Stat UCL | 0.00308 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.00449

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

Zinc

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 21 |
| Minimum | 17 | Mean | 31.75 |
| Maximum | 44 | Median | 31 |
| SD | 6.415 | Std. Error of Mean | 1.212 |
| Coefficient of Variation | 0.202 | Skewness | -0.0328 |

| Normal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.965 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.139 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 33.82 | 95% Adjusted-CLT UCL (Chen-1995) | 33.74 |
| | | 95% Modified-t UCL (Johnson-1978) | 33.81 |

| Gamma GOF Test | | |
|---|---|---|
| A-D Test Statistic | 0.456 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.744 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.15 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.165 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 24.08 | k star (bias corrected MLE) | 21.52 |
| Theta hat (MLE) | 1.319 | Theta star (bias corrected MLE) | 1.475 |
| nu hat (MLE) | 1348 | nu star (bias corrected) | 1205 |
| MLE Mean (bias corrected) | 31.75 | MLE Sd (bias corrected) | 6.844 |
| | | Approximate Chi Square Value (0.05) | 1126 |
| Adjusted Level of Significance | 0.0404 | Adjusted Chi Square Value | 1121 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 34 | 95% Adjusted Gamma UCL (use when n<50) | 34.14 |

| Lognormal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.148 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.833 | Mean of logged Data | 3.437 |
| Maximum of Logged Data | 3.784 | SD of logged Data | 0.212 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 34.17 | 90% Chebyshev (MVUE) UCL | 35.64 |
| 95% Chebyshev (MVUE) UCL | 37.38 | 97.5% Chebyshev (MVUE) UCL | 39.81 |
| 99% Chebyshev (MVUE) UCL | 44.58 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 33.74 | 95% Jackknife UCL | 33.82 |
| 95% Standard Bootstrap UCL | 33.66 | 95% Bootstrap-t UCL | 33.7 |
| 95% Hall's Bootstrap UCL | 33.69 | 95% Percentile Bootstrap UCL | 33.71 |
| 95% BCA Bootstrap UCL | 33.71 | | |
| 90% Chebyshev(Mean, Sd) UCL | 35.39 | 95% Chebyshev(Mean, Sd) UCL | 37.03 |
| 97.5% Chebyshev(Mean, Sd) UCL | 39.32 | 99% Chebyshev(Mean, Sd) UCL | 43.81 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 33.82 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

Fish Tissue

Total PCBs (Aroclors)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 27 |
| | | Number of Missing Observations | 36 |
| Minimum | 31 | Mean | 211.4 |
| Maximum | 440 | Median | 169 |
| SD | 112.3 | Std. Error of Mean | 20.85 |
| Coefficient of Variation | 0.531 | Skewness | 0.552 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.926 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.189 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 246.9 | 95% Adjusted-CLT UCL (Chen-1995) | 248 |
| | | 95% Modified-t UCL (Johnson-1978) | 247.2 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.449 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.752 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.124 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.164 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.4 | k star (bias corrected MLE) | 3.072 |
| Theta hat (MLE) | 62.17 | Theta star (bias corrected MLE) | 68.82 |
| nu hat (MLE) | 197.2 | nu star (bias corrected) | 178.2 |
| MLE Mean (bias corrected) | 211.4 | MLE Sd (bias corrected) | 120.6 |
| | | Approximate Chi Square Value (0.05) | 148.3 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 146.7 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 254 | 95% Adjusted Gamma UCL (use when n<50) | 256.8 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.943 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.111 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.434 | Mean of logged Data | 5.2 |
| Maximum of Logged Data | 6.087 | SD of logged Data | 0.601 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 273.3 | 90% Chebyshev (MVUE) UCL | 291.9 |
| 95% Chebyshev (MVUE) UCL | 326.6 | 97.5% Chebyshev (MVUE) UCL | 374.7 |
| 99% Chebyshev (MVUE) UCL | 469.1 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 245.7 | 95% Jackknife UCL | 246.9 |
| 95% Standard Bootstrap UCL | 244.7 | 95% Bootstrap-t UCL | 249.5 |
| 95% Hall's Bootstrap UCL | 247.8 | 95% Percentile Bootstrap UCL | 245.4 |
| 95% BCA Bootstrap UCL | 247.1 | | |
| 90% Chebyshev(Mean, Sd) UCL | 273.9 | 95% Chebyshev(Mean, Sd) UCL | 302.3 |
| 97.5% Chebyshev(Mean, Sd) UCL | 341.6 | 99% Chebyshev(Mean, Sd) UCL | 418.8 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Adjusted Gamma UCL | 256.8 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Fish Tissue

### Total PCBs (Congeners)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 28 |
| | | Number of Missing Observations | 37 |
| Minimum | 199.3 | Mean | 330.7 |
| Maximum | 487 | Median | 320.8 |
| SD | 66.37 | Std. Error of Mean | 12.54 |
| Coefficient of Variation | 0.201 | Skewness | 0.343 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.984 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.101 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 352 | 95% Adjusted-CLT UCL (Chen-1995) | 352.2 |
| | | 95% Modified-t UCL (Johnson-1978) | 352.2 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.148 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.744 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.081 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.165 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 25.66 | k star (bias corrected MLE) | 22.94 |
| Theta hat (MLE) | 12.89 | Theta star (bias corrected MLE) | 14.42 |
| nu hat (MLE) | 1437 | nu star (bias corrected) | 1284 |
| MLE Mean (bias corrected) | 330.7 | MLE Sd (bias corrected) | 69.05 |
| | | Approximate Chi Square Value (0.05) | 1202 |
| Adjusted Level of Significance | 0.0404 | Adjusted Chi Square Value | 1197 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 353.3 | 95% Adjusted Gamma UCL (use when n<50) | 354.7 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.989 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0672 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 5.295 | Mean of logged Data | 5.782 |
| Maximum of Logged Data | 6.188 | SD of logged Data | 0.203 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 354.4 | 90% Chebyshev (MVUE) UCL | 369.1 |
| 95% Chebyshev (MVUE) UCL | 386.5 | 97.5% Chebyshev (MVUE) UCL | 410.6 |
| 99% Chebyshev (MVUE) UCL | 457.9 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 351.3 | 95% Jackknife UCL | 352 |
| 95% Standard Bootstrap UCL | 351.6 | 95% Bootstrap-t UCL | 353.4 |
| 95% Hall's Bootstrap UCL | 352.6 | 95% Percentile Bootstrap UCL | 351.6 |
| 95% BCA Bootstrap UCL | 353.4 | | |
| 90% Chebyshev(Mean, Sd) UCL | 368.3 | 95% Chebyshev(Mean, Sd) UCL | 385.4 |
| 97.5% Chebyshev(Mean, Sd) UCL | 409 | 99% Chebyshev(Mean, Sd) UCL | 455.5 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 352 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

4,4'-DDD

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 36 |
| Minimum | 2 | Mean | 6.221 |
| Maximum | 11 | Median | 6 |
| SD | 2.622 | Std. Error of Mean | 0.487 |
| Coefficient of Variation | 0.421 | Skewness | 0.111 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.955 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.093 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 7.049 | 95% Adjusted-CLT UCL (Chen-1995) | 7.032 |
| | | 95% Modified-t UCL (Johnson-1978) | 7.051 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.402 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.748 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.12 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.163 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.08 | k star (bias corrected MLE) | 4.577 |
| Theta hat (MLE) | 1.225 | Theta star (bias corrected MLE) | 1.359 |
| nu hat (MLE) | 294.6 | nu star (bias corrected) | 265.5 |
| MLE Mean (bias corrected) | 6.221 | MLE Sd (bias corrected) | 2.908 |
| | | Approximate Chi Square Value (0.05) | 228.7 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 226.7 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 7.22 | 95% Adjusted Gamma UCL (use when n<50) | 7.284 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.931 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.122 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.693 | Mean of logged Data | 1.726 |
| Maximum of Logged Data | 2.398 | SD of logged Data | 0.484 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 7.542 | 90% Chebyshev (MVUE) UCL | 8.057 |
| 95% Chebyshev (MVUE) UCL | 8.857 | 97.5% Chebyshev (MVUE) UCL | 9.967 |
| 99% Chebyshev (MVUE) UCL | 12.15 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 7.022 | 95% Jackknife UCL | 7.049 |
| 95% Standard Bootstrap UCL | 7.022 | 95% Bootstrap-t UCL | 7.102 |
| 95% Hall's Bootstrap UCL | 7.024 | 95% Percentile Bootstrap UCL | 6.983 |
| 95% BCA Bootstrap UCL | 7.072 | | |
| 90% Chebyshev(Mean, Sd) UCL | 7.681 | 95% Chebyshev(Mean, Sd) UCL | 8.343 |
| 97.5% Chebyshev(Mean, Sd) UCL | 9.261 | 99% Chebyshev(Mean, Sd) UCL | 11.07 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 7.049 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

4,4'-DDE

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 36 |
| Minimum | 7.3 | Mean | 15.98 |
| Maximum | 24 | Median | 16 |
| SD | 4.438 | Std. Error of Mean | 0.824 |
| Coefficient of Variation | 0.278 | Skewness | 0.13 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.965 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.121 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 17.38 | 95% Adjusted-CLT UCL (Chen-1995) | 17.36 |
| | | 95% Modified-t UCL (Johnson-1978) | 17.39 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.328 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.745 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.106 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.162 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 12.66 | k star (bias corrected MLE) | 11.37 |
| Theta hat (MLE) | 1.263 | Theta star (bias corrected MLE) | 1.406 |
| nu hat (MLE) | 734.2 | nu star (bias corrected) | 659.5 |
| MLE Mean (bias corrected) | 15.98 | MLE Sd (bias corrected) | 4.74 |
| | | Approximate Chi Square Value (0.05) | 601 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 597.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 17.54 | 95% Adjusted Gamma UCL (use when n<50) | 17.64 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.957 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.118 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.988 | Mean of logged Data | 2.731 |
| Maximum of Logged Data | 3.178 | SD of logged Data | 0.295 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 17.74 | 90% Chebyshev (MVUE) UCL | 18.69 |
| 95% Chebyshev (MVUE) UCL | 19.9 | 97.5% Chebyshev (MVUE) UCL | 21.58 |
| 99% Chebyshev (MVUE) UCL | 24.89 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 17.34 | 95% Jackknife UCL | 17.38 |
| 95% Standard Bootstrap UCL | 17.32 | 95% Bootstrap-t UCL | 17.41 |
| 95% Hall's Bootstrap UCL | 17.4 | 95% Percentile Bootstrap UCL | 17.36 |
| 95% BCA Bootstrap UCL | 17.29 | | |
| 90% Chebyshev(Mean, Sd) UCL | 18.46 | 95% Chebyshev(Mean, Sd) UCL | 19.58 |
| 97.5% Chebyshev(Mean, Sd) UCL | 21.13 | 99% Chebyshev(Mean, Sd) UCL | 24.18 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 17.38 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

# Fish Tissue

### 4,4'-DDT

| | | | |
|---|---|---|---|
| | **General Statistics** | | |
| Total Number of Observations | 29 | Number of Distinct Observations | 22 |
| | | Number of Missing Observations | 36 |
| Minimum | 0.82 | Mean | 2.566 |
| Maximum | 12 | Median | 1.7 |
| SD | 2.7 | Std. Error of Mean | 0.501 |
| Coefficient of Variation | 1.052 | Skewness | 2.619 |
| | **Normal GOF Test** | | |
| Shapiro Wilk Test Statistic | 0.588 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.926 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.323 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.161 | Data Not Normal at 5% Significance Level | |
| | **Data Not Normal at 5% Significance Level** | | |
| | **Assuming Normal Distribution** | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 3.419 | 95% Adjusted-CLT UCL (Chen-1995) | 3.651 |
| | | 95% Modified-t UCL (Johnson-1978) | 3.46 |
| | **Gamma GOF Test** | | |
| A-D Test Statistic | 2.41 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.759 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.23 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.165 | Data Not Gamma Distributed at 5% Significance Level | |
| | **Data Not Gamma Distributed at 5% Significance Level** | | |
| | **Gamma Statistics** | | |
| k hat (MLE) | 1.849 | k star (bias corrected MLE) | 1.681 |
| Theta hat (MLE) | 1.388 | Theta star (bias corrected MLE) | 1.527 |
| nu hat (MLE) | 107.2 | nu star (bias corrected) | 97.47 |
| MLE Mean (bias corrected) | 2.566 | MLE Sd (bias corrected) | 1.979 |
| | | Approximate Chi Square Value (0.05) | 75.7 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 74.55 |
| | **Assuming Gamma Distribution** | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 3.304 | 95% Adjusted Gamma UCL (use when n<50) | 3.355 |
| | **Lognormal GOF Test** | | |
| Shapiro Wilk Test Statistic | 0.862 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.926 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.163 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.161 | Data Not Lognormal at 5% Significance Level | |
| | **Data Not Lognormal at 5% Significance Level** | | |
| | **Lognormal Statistics** | | |
| Minimum of Logged Data | -0.198 | Mean of logged Data | 0.648 |
| Maximum of Logged Data | 2.485 | SD of logged Data | 0.683 |
| | **Assuming Lognormal Distribution** | | |
| 95% H-UCL | 3.171 | 90% Chebyshev (MVUE) UCL | 3.371 |
| 95% Chebyshev (MVUE) UCL | 3.814 | 97.5% Chebyshev (MVUE) UCL | 4.43 |
| 99% Chebyshev (MVUE) UCL | 5.64 | | |
| | **Nonparametric Distribution Free UCL Statistics** | | |
| | **Data do not follow a Discernible Distribution (0.05)** | | |
| | **Nonparametric Distribution Free UCLs** | | |
| 95% CLT UCL | 3.391 | 95% Jackknife UCL | 3.419 |
| 95% Standard Bootstrap UCL | 3.367 | 95% Bootstrap-t UCL | 3.998 |
| 95% Hall's Bootstrap UCL | 3.391 | 95% Percentile Bootstrap UCL | 3.409 |
| 95% BCA Bootstrap UCL | 3.7 | | |
| 90% Chebyshev(Mean, Sd) UCL | 4.07 | 95% Chebyshev(Mean, Sd) UCL | 4.752 |
| 97.5% Chebyshev(Mean, Sd) UCL | 5.698 | 99% Chebyshev(Mean, Sd) UCL | 7.555 |
| | **Suggested UCL to Use** | | |
| 95% Chebyshev (Mean, Sd) UCL | 4.752 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

ALDRIN

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 21 |
| | | Number of Missing Observations | 36 |
| Minimum | 0.4 | Mean | 1.209 |
| Maximum | 2.4 | Median | 1.1 |
| SD | 0.485 | Std. Error of Mean | 0.0901 |
| Coefficient of Variation | 0.402 | Skewness | 0.681 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.945 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.14 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 1.362 | 95% Adjusted-CLT UCL (Chen-1995) | 1.369 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.364 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.386 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.747 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.123 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.163 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.215 | k star (bias corrected MLE) | 5.595 |
| Theta hat (MLE) | 0.194 | Theta star (bias corrected MLE) | 0.216 |
| nu hat (MLE) | 360.5 | nu star (bias corrected) | 324.5 |
| MLE Mean (bias corrected) | 1.209 | MLE Sd (bias corrected) | 0.511 |
| | | Approximate Chi Square Value (0.05) | 283.8 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 281.5 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.382 | 95% Adjusted Gamma UCL (use when n<50) | 1.393 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.95 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.147 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.916 | Mean of logged Data | 0.107 |
| Maximum of Logged Data | 0.875 | SD of logged Data | 0.429 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.422 | 90% Chebyshev (MVUE) UCL | 1.516 |
| 95% Chebyshev (MVUE) UCL | 1.652 | 97.5% Chebyshev (MVUE) UCL | 1.84 |
| 99% Chebyshev (MVUE) UCL | 2.211 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.357 | 95% Jackknife UCL | 1.362 |
| 95% Standard Bootstrap UCL | 1.356 | 95% Bootstrap-t UCL | 1.375 |
| 95% Hall's Bootstrap UCL | 1.377 | 95% Percentile Bootstrap UCL | 1.362 |
| 95% BCA Bootstrap UCL | 1.372 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.479 | 95% Chebyshev(Mean, Sd) UCL | 1.602 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.772 | 99% Chebyshev(Mean, Sd) UCL | 2.106 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 1.362 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

alpha-BHC

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 26 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 27 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 25 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.18 | Minimum Non-Detect | 0.1 |
| Maximum Detect | 1.9 | Maximum Non-Detect | 0.1 |
| Variance Detects | 0.155 | Percent Non-Detects | 6.897% |
| Mean Detects | 0.724 | SD Detects | 0.394 |
| Median Detects | 0.68 | CV Detects | 0.544 |
| Skewness Detects | 1.086 | Kurtosis Detects | 1.751 |
| Mean of Logged Detects | -0.471 | SD of Logged Detects | 0.578 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.933 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.107 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.167 | Detected Data appear Normal at 5% Significance Level |

**Detected Data appear Normal at 5% Significance Level**

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.681 | KM Standard Error of Mean | 0.0767 |
| KM SD | 0.405 | 95% KM (BCA) UCL | 0.806 |
| 95% KM (t) UCL | 0.811 | 95% KM (Percentile Bootstrap) UCL | 0.805 |
| 95% KM (z) UCL | 0.807 | 95% KM Bootstrap t UCL | 0.834 |
| 90% KM Chebyshev UCL | 0.911 | 95% KM Chebyshev UCL | 1.015 |
| 97.5% KM Chebyshev UCL | 1.16 | 99% KM Chebyshev UCL | 1.444 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.139 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.75 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0788 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.169 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.531 | k star (bias corrected MLE) | 3.163 |
| Theta hat (MLE) | 0.205 | Theta star (bias corrected MLE) | 0.229 |
| nu hat (MLE) | 190.7 | nu star (bias corrected) | 170.8 |
| Mean (detects) | 0.724 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0401 | Mean | 0.679 |
| Maximum | 1.9 | Median | 0.65 |
| SD | 0.416 | CV | 0.612 |
| k hat (MLE) | 2.212 | k star (bias corrected MLE) | 2.006 |
| Theta hat (MLE) | 0.307 | Theta star (bias corrected MLE) | 0.338 |
| nu hat (MLE) | 128.3 | nu star (bias corrected) | 116.3 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (116.33, α) | 92.43 | Adjusted Chi Square Value (116.33, β) | 91.16 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.854 | 95% Gamma Adjusted UCL (use when n<50) | 0.866 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.681 | SD (KM) | 0.405 |
| Variance (KM) | 0.164 | SE of Mean (KM) | 0.0767 |
| k hat (KM) | 2.827 | k star (KM) | 2.557 |
| nu hat (KM) | 164 | nu star (KM) | 148.3 |
| theta hat (KM) | 0.241 | theta star (KM) | 0.266 |
| 80% gamma percentile (KM) | 0.99 | 90% gamma percentile (KM) | 1.252 |
| 95% gamma percentile (KM) | 1.498 | 99% gamma percentile (KM) | 2.036 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (148.32, α) | 121.2 | Adjusted Chi Square Value (148.32, β) | 119.7 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.834 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.844 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.975 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.923 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.103 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.167 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.685 | Mean in Log Scale | -0.565 |
| SD in Original Scale | 0.406 | SD in Log Scale | 0.659 |
| 95% t UCL (assumes normality of ROS data) | 0.814 | 95% Percentile Bootstrap UCL | 0.801 |
| 95% BCA Bootstrap UCL | 0.828 | 95% Bootstrap t UCL | 0.836 |
| 95% H-UCL (Log ROS) | 0.916 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.597 | KM Geo Mean | 0.55 |
| KM SD (logged) | 0.717 | 95% Critical H Value (KM-Log) | 2.146 |
| KM Standard Error of Mean (logged) | 0.136 | 95% H-UCL (KM -Log) | 0.952 |
| KM SD (logged) | 0.717 | 95% Critical H Value (KM-Log) | 2.146 |
| KM Standard Error of Mean (logged) | 0.136 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.678 | Mean in Log Scale | -0.645 |
| SD in Original Scale | 0.417 | SD in Log Scale | 0.857 |
| 95% t UCL (Assumes normality) | 0.809 | 95% H-Stat UCL | 1.098 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.811

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

beta-BHC

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 24 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 16 | Number of Non-Detects | 13 |
| Number of Distinct Detects | 15 | Number of Distinct Non-Detects | 12 |
| Minimum Detect | 0.11 | Minimum Non-Detect | 0.16 |
| Maximum Detect | 2.2 | Maximum Non-Detect | 1.5 |
| Variance Detects | 0.264 | Percent Non-Detects | 44.83% |
| Mean Detects | 0.889 | SD Detects | 0.513 |
| Median Detects | 0.68 | CV Detects | 0.578 |
| Skewness Detects | 1.081 | Kurtosis Detects | 1.518 |
| Mean of Logged Detects | -0.297 | SD of Logged Detects | 0.682 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.914 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.213 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data Not Normal at 5% Significance Level |

Detected Data appear Approximate Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.609 | KM Standard Error of Mean | 0.102 |
| KM SD | 0.508 | 95% KM (BCA) UCL | 0.804 |
| 95% KM (t) UCL | 0.783 | 95% KM (Percentile Bootstrap) UCL | 0.788 |
| 95% KM (z) UCL | 0.777 | 95% KM Bootstrap t UCL | 0.799 |
| 90% KM Chebyshev UCL | 0.916 | 95% KM Chebyshev UCL | 1.054 |
| 97.5% KM Chebyshev UCL | 1.247 | 99% KM Chebyshev UCL | 1.625 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.393 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.745 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.149 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.217 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.947 | k star (bias corrected MLE) | 2.436 |
| Theta hat (MLE) | 0.302 | Theta star (bias corrected MLE) | 0.365 |
| nu hat (MLE) | 94.31 | nu star (bias corrected) | 77.96 |
| Mean (detects) | 0.889 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.104 | Mean | 0.602 |
| Maximum | 2.2 | Median | 0.46 |
| SD | 0.504 | CV | 0.838 |
| k hat (MLE) | 1.554 | k star (bias corrected MLE) | 1.416 |
| Theta hat (MLE) | 0.387 | Theta star (bias corrected MLE) | 0.425 |
| nu hat (MLE) | 90.14 | nu star (bias corrected) | 82.15 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (82.15, α) | 62.26 | Adjusted Chi Square Value (82.15, β) | 61.23 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.794 | 95% Gamma Adjusted UCL (use when n<50) | 0.807 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.609 | SD (KM) | 0.508 |
| Variance (KM) | 0.258 | SE of Mean (KM) | 0.102 |
| k hat (KM) | 1.441 | k star (KM) | 1.315 |
| nu hat (KM) | 83.56 | nu star (KM) | 76.25 |
| theta hat (KM) | 0.423 | theta star (KM) | 0.464 |
| 80% gamma percentile (KM) | 0.956 | 90% gamma percentile (KM) | 1.312 |
| 95% gamma percentile (KM) | 1.66 | 99% gamma percentile (KM) | 2.453 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (76.25, α) | 57.14 | Adjusted Chi Square Value (76.25, β) | 56.15 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.813 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.828 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.895 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.179 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.213 | Detected Data appear Lognormal at 5% Significance Level | |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.622 | Mean in Log Scale | -0.73 |
| SD in Original Scale | 0.485 | SD in Log Scale | 0.724 |
| 95% t UCL (assumes normality of ROS data) | 0.775 | 95% Percentile Bootstrap UCL | 0.77 |
| 95% BCA Bootstrap UCL | 0.801 | 95% Bootstrap t UCL | 0.811 |
| 95% H-UCL (Log ROS) | 0.841 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.912 | KM Geo Mean | 0.402 |
| KM SD (logged) | 0.99 | 95% Critical H Value (KM-Log) | 2.455 |
| KM Standard Error of Mean (logged) | 0.216 | 95% H-UCL (KM -Log) | 1.038 |
| KM SD (logged) | 0.99 | 95% Critical H Value (KM-Log) | 2.455 |
| KM Standard Error of Mean (logged) | 0.216 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.627 | Mean in Log Scale | -0.761 |
| SD in Original Scale | 0.491 | SD in Log Scale | 0.817 |
| 95% t UCL (Assumes normality) | 0.782 | 95% H-Stat UCL | 0.923 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Approximate Normal Distributed at 5% Significance Level**

**Suggested UCL to Use**

95% KM (t) UCL 0.783

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 22 |
| | | Number of Missing Observations | 36 |
| Minimum | 39 | Mean | 116.3 |
| Maximum | 220 | Median | 110 |
| SD | 53.53 | Std. Error of Mean | 9.939 |
| Coefficient of Variation | 0.46 | Skewness | 0.485 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 133.3 | 95% Adjusted-CLT UCL (Chen-1995) | 133.6 |
| | | 95% Modified-t UCL (Johnson-1978) | 133.4 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.316 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.748 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.111 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.163 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.68 | k star (bias corrected MLE) | 4.219 |
| Theta hat (MLE) | 24.86 | Theta star (bias corrected MLE) | 27.58 |
| nu hat (MLE) | 271.5 | nu star (bias corrected) | 244.7 |
| MLE Mean (bias corrected) | 116.3 | MLE Sd (bias corrected) | 56.64 |
| | | Approximate Chi Square Value (0.05) | 209.5 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 207.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 135.9 | 95% Adjusted Gamma UCL (use when n<50) | 137.2 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.953 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0957 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.664 | Mean of logged Data | 4.646 |
| Maximum of Logged Data | 5.394 | SD of logged Data | 0.494 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 141.1 | 90% Chebyshev (MVUE) UCL | 150.8 |
| 95% Chebyshev (MVUE) UCL | 166 | 97.5% Chebyshev (MVUE) UCL | 187.1 |
| 99% Chebyshev (MVUE) UCL | 228.7 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 132.7 | 95% Jackknife UCL | 133.3 |
| 95% Standard Bootstrap UCL | 132.2 | 95% Bootstrap-t UCL | 134.2 |
| 95% Hall's Bootstrap UCL | 134.3 | 95% Percentile Bootstrap UCL | 132.3 |
| 95% BCA Bootstrap UCL | 132.1 | | |
| 90% Chebyshev(Mean, Sd) UCL | 146.2 | 95% Chebyshev(Mean, Sd) UCL | 159.7 |
| 97.5% Chebyshev(Mean, Sd) UCL | 178.4 | 99% Chebyshev(Mean, Sd) UCL | 215.2 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 133.3 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

delta-BHC

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 20 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 24 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 19 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.16 | Minimum Non-Detect | 0.064 |
| Maximum Detect | 3.2 | Maximum Non-Detect | 0.16 |
| Variance Detects | 0.513 | Percent Non-Detects | 17.24% |
| Mean Detects | 1.379 | SD Detects | 0.716 |
| Median Detects | 1.35 | CV Detects | 0.519 |
| Skewness Detects | 0.28 | Kurtosis Detects | 0.503 |
| Mean of Logged Detects | 0.123 | SD of Logged Detects | 0.753 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.968 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.916 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.177 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 1.152 | KM Standard Error of Mean | 0.153 |
| KM SD | 0.808 | 95% KM (BCA) UCL | 1.375 |
| 95% KM (t) UCL | 1.413 | 95% KM (Percentile Bootstrap) UCL | 1.399 |
| 95% KM (z) UCL | 1.404 | 95% KM Bootstrap t UCL | 1.415 |
| 90% KM Chebyshev UCL | 1.612 | 95% KM Chebyshev UCL | 1.82 |
| 97.5% KM Chebyshev UCL | 2.109 | 99% KM Chebyshev UCL | 2.677 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.797 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.752 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.211 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.18 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.676 | k star (bias corrected MLE) | 2.369 |
| Theta hat (MLE) | 0.515 | Theta star (bias corrected MLE) | 0.582 |
| nu hat (MLE) | 128.4 | nu star (bias corrected) | 113.7 |
| Mean (detects) | 1.379 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.125 | Mean | 1.187 |
| Maximum | 3.2 | Median | 1.3 |
| SD | 0.778 | CV | 0.656 |
| k hat (MLE) | 1.763 | k star (bias corrected MLE) | 1.604 |
| Theta hat (MLE) | 0.673 | Theta star (bias corrected MLE) | 0.74 |
| nu hat (MLE) | 102.3 | nu star (bias corrected) | 93.03 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (93.03, α) | 71.79 | Adjusted Chi Square Value (93.03, β) | 70.67 |
| 95% Gamma Approximate UCL (use when n>=50) | 1.538 | 95% Gamma Adjusted UCL (use when n<50) | 1.562 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 1.152 | SD (KM) | 0.808 |
| Variance (KM) | 0.653 | SE of Mean (KM) | 0.153 |
| k hat (KM) | 2.032 | k star (KM) | 1.845 |
| nu hat (KM) | 117.9 | nu star (KM) | 107 |
| theta hat (KM) | 0.567 | theta star (KM) | 0.624 |
| 80% gamma percentile (KM) | 1.741 | 90% gamma percentile (KM) | 2.284 |
| 95% gamma percentile (KM) | 2.804 | 99% gamma percentile (KM) | 3.963 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (107.00, α) | 84.13 | Adjusted Chi Square Value (107.00, β) | 82.92 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.465 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.487 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.846 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.916 | Detected Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.24 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.177 | Detected Data Not Lognormal at 5% Significance Level | |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.185 | Mean in Log Scale | -0.139 |
| SD in Original Scale | 0.78 | SD in Log Scale | 0.903 |
| 95% t UCL (assumes normality of ROS data) | 1.431 | 95% Percentile Bootstrap UCL | 1.418 |
| 95% BCA Bootstrap UCL | 1.431 | 95% Bootstrap t UCL | 1.432 |
| 95% H-UCL (Log ROS) | 1.952 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.372 | KM Geo Mean | 0.689 |
| KM SD (logged) | 1.275 | 95% Critical H Value (KM-Log) | 2.827 |
| KM Standard Error of Mean (logged) | 0.242 | 95% H-UCL (KM -Log) | 3.071 |
| KM SD (logged) | 1.275 | 95% Critical H Value (KM-Log) | 2.827 |
| KM Standard Error of Mean (logged) | 0.242 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.148 | Mean in Log Scale | -0.46 |
| SD in Original Scale | 0.828 | SD in Log Scale | 1.476 |
| 95% t UCL (Assumes normality) | 1.41 | 95% H-Stat UCL | 4.471 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 1.413

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

DIELDRIN

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 23 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 28 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 22 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 1.6 | Minimum Non-Detect | 0.07 |
| Maximum Detect | 13 | Maximum Non-Detect | 0.07 |
| Variance Detects | 9.157 | Percent Non-Detects | 3.448% |
| Mean Detects | 5.839 | SD Detects | 3.026 |
| Median Detects | 5.7 | CV Detects | 0.518 |
| Skewness Detects | 0.63 | Kurtosis Detects | -0.328 |
| Mean of Logged Detects | 1.624 | SD of Logged Detects | 0.562 |

| Normal GOF Test on Detects Only | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.939 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk Critical Value | 0.924 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.151 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.164 | Detected Data appear Normal at 5% Significance Level |
| Detected Data appear Normal at 5% Significance Level | | |

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 5.64 | KM Standard Error of Mean | 0.587 |
| KM SD | 3.104 | 95% KM (BCA) UCL | 6.699 |
| 95% KM (t) UCL | 6.639 | 95% KM (Percentile Bootstrap) UCL | 6.607 |
| 95% KM (z) UCL | 6.606 | 95% KM Bootstrap t UCL | 6.697 |
| 90% KM Chebyshev UCL | 7.401 | 95% KM Chebyshev UCL | 8.199 |
| 97.5% KM Chebyshev UCL | 9.306 | 99% KM Chebyshev UCL | 11.48 |

| Gamma GOF Tests on Detected Observations Only | | |
|---|---|---|
| A-D Test Statistic | 0.298 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0965 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.166 | Detected data appear Gamma Distributed at 5% Significance Level |
| Detected data appear Gamma Distributed at 5% Significance Level | | |

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 3.706 | k star (bias corrected MLE) | 3.332 |
| Theta hat (MLE) | 1.576 | Theta star (bias corrected MLE) | 1.752 |
| nu hat (MLE) | 207.5 | nu star (bias corrected) | 186.6 |
| Mean (detects) | 5.839 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.657 | Mean | 5.661 |
| Maximum | 13 | Median | 5.5 |
| SD | 3.123 | CV | 0.552 |
| k hat (MLE) | 2.929 | k star (bias corrected MLE) | 2.649 |
| Theta hat (MLE) | 1.933 | Theta star (bias corrected MLE) | 2.137 |
| nu hat (MLE) | 169.9 | nu star (bias corrected) | 153.6 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (153.63, α) | 126 | Adjusted Chi Square Value (153.63, β) | 124.5 |
| 95% Gamma Approximate UCL (use when n>=50) | 6.903 | 95% Gamma Adjusted UCL (use when n<50) | 6.986 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 5.64 | SD (KM) | 3.104 |
| Variance (KM) | 9.633 | SE of Mean (KM) | 0.587 |
| k hat (KM) | 3.302 | k star (KM) | 2.984 |
| nu hat (KM) | 191.5 | nu star (KM) | 173.1 |
| theta hat (KM) | 1.708 | theta star (KM) | 1.89 |
| 80% gamma percentile (KM) | 8.05 | 90% gamma percentile (KM) | 10.02 |
| 95% gamma percentile (KM) | 11.86 | 99% gamma percentile (KM) | 15.84 |

| Gamma Kaplan-Meier (KM) Statistics | | | |
|---|---|---|---|
| Approximate Chi Square Value (173.06, α) | 143.6 | Adjusted Chi Square Value (173.06, β) | 142 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 6.796 | 95% Gamma Adjusted KM-UCL (use when n<50) | 6.872 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.963 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.924 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.115 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.164 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 5.681 | Mean in Log Scale | 1.575 |
| SD in Original Scale | 3.091 | SD in Log Scale | 0.61 |
| 95% t UCL (assumes normality of ROS data) | 6.657 | 95% Percentile Bootstrap UCL | 6.591 |
| 95% BCA Bootstrap UCL | 6.696 | 95% Bootstrap t UCL | 6.729 |
| 95% H-UCL (Log ROS) | 7.364 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | 1.476 | KM Geo Mean | 4.375 |
| KM SD (logged) | 0.951 | 95% Critical H Value (KM-Log) | 2.407 |
| KM Standard Error of Mean (logged) | 0.18 | 95% H-UCL (KM -Log) | 10.6 |
| KM SD (logged) | 0.951 | 95% Critical H Value (KM-Log) | 2.407 |
| KM Standard Error of Mean (logged) | 0.18 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 5.639 | Mean in Log Scale | 1.452 |
| SD in Original Scale | 3.161 | SD in Log Scale | 1.076 |
| 95% t UCL (Assumes normality) | 6.638 | 95% H-Stat UCL | 12.83 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 6.639

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 21 |
| | | Number of Missing Observations | 36 |
| Minimum | 1.6 | Mean | 4.431 |
| Maximum | 10 | Median | 4.1 |
| SD | 1.543 | Std. Error of Mean | 0.287 |
| Coefficient of Variation | 0.348 | Skewness | 1.542 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.886 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.141 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 4.919 | 95% Adjusted-CLT UCL (Chen-1995) | 4.99 |
| | | 95% Modified-t UCL (Johnson-1978) | 4.932 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.492 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.746 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.11 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.163 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 9.368 | k star (bias corrected MLE) | 8.421 |
| Theta hat (MLE) | 0.473 | Theta star (bias corrected MLE) | 0.526 |
| nu hat (MLE) | 543.3 | nu star (bias corrected) | 488.4 |
| MLE Mean (bias corrected) | 4.431 | MLE Sd (bias corrected) | 1.527 |
| | | Approximate Chi Square Value (0.05) | 438.2 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 435.4 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 4.939 | 95% Adjusted Gamma UCL (use when n<50) | 4.971 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.956 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.108 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.47 | Mean of logged Data | 1.434 |
| Maximum of Logged Data | 2.303 | SD of logged Data | 0.338 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 4.994 | 90% Chebyshev (MVUE) UCL | 5.286 |
| 95% Chebyshev (MVUE) UCL | 5.672 | 97.5% Chebyshev (MVUE) UCL | 6.208 |
| 99% Chebyshev (MVUE) UCL | 7.26 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 4.902 | 95% Jackknife UCL | 4.919 |
| 95% Standard Bootstrap UCL | 4.887 | 95% Bootstrap-t UCL | 5.032 |
| 95% Hall's Bootstrap UCL | 5.255 | 95% Percentile Bootstrap UCL | 4.903 |
| 95% BCA Bootstrap UCL | 4.986 | | |
| 90% Chebyshev(Mean, Sd) UCL | 5.291 | 95% Chebyshev(Mean, Sd) UCL | 5.68 |
| 97.5% Chebyshev(Mean, Sd) UCL | 6.221 | 99% Chebyshev(Mean, Sd) UCL | 7.283 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 4.919 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

Endosulfan II

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 24 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 24 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 21 | Number of Distinct Non-Detects | 5 |
| Minimum Detect | 0.19 | Minimum Non-Detect | 0.13 |
| Maximum Detect | 4.4 | Maximum Non-Detect | 0.38 |
| Variance Detects | 1.674 | Percent Non-Detects | 17.24% |
| Mean Detects | 1.271 | SD Detects | 1.294 |
| Median Detects | 0.88 | CV Detects | 1.018 |
| Skewness Detects | 1.576 | Kurtosis Detects | 1.42 |
| Mean of Logged Detects | -0.2 | SD of Logged Detects | 0.956 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.755 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.916 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.261 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.177 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 1.083 | KM Standard Error of Mean | 0.232 |
| KM SD | 1.224 | 95% KM (BCA) UCL | 1.516 |
| 95% KM (t) UCL | 1.478 | 95% KM (Percentile Bootstrap) UCL | 1.475 |
| 95% KM (z) UCL | 1.465 | 95% KM Bootstrap t UCL | 1.623 |
| 90% KM Chebyshev UCL | 1.779 | 95% KM Chebyshev UCL | 2.095 |
| 97.5% KM Chebyshev UCL | 2.533 | 99% KM Chebyshev UCL | 3.394 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.757 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.766 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.152 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.182 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.276 | k star (bias corrected MLE) | 1.144 |
| Theta hat (MLE) | 0.996 | Theta star (bias corrected MLE) | 1.111 |
| nu hat (MLE) | 61.26 | nu star (bias corrected) | 54.93 |
| Mean (detects) | 1.271 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 1.054 |
| Maximum | 4.4 | Median | 0.69 |
| SD | 1.269 | CV | 1.204 |
| k hat (MLE) | 0.609 | k star (bias corrected MLE) | 0.569 |
| Theta hat (MLE) | 1.73 | Theta star (bias corrected MLE) | 1.852 |
| nu hat (MLE) | 35.33 | nu star (bias corrected) | 33 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (33.00, α) | 20.87 | Adjusted Chi Square Value (33.00, β) | 20.29 |
| 95% Gamma Approximate UCL (use when n>=50) | 1.666 | 95% Gamma Adjusted UCL (use when n<50) | 1.714 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 1.083 | SD (KM) | 1.224 |
| Variance (KM) | 1.499 | SE of Mean (KM) | 0.232 |
| k hat (KM) | 0.782 | k star (KM) | 0.724 |
| nu hat (KM) | 45.36 | nu star (KM) | 42 |
| theta hat (KM) | 1.384 | theta star (KM) | 1.495 |
| 80% gamma percentile (KM) | 1.777 | 90% gamma percentile (KM) | 2.696 |
| 95% gamma percentile (KM) | 3.64 | 99% gamma percentile (KM) | 5.888 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (42.00, α) | 28.14 | Adjusted Chi Square Value (42.00, β) | 27.47 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.616 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.656 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.945 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.916 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.109 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.177 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.076 | Mean in Log Scale | -0.521 |
| SD in Original Scale | 1.251 | SD in Log Scale | 1.133 |
| 95% t UCL (assumes normality of ROS data) | 1.471 | 95% Percentile Bootstrap UCL | 1.467 |
| 95% BCA Bootstrap UCL | 1.534 | 95% Bootstrap t UCL | 1.606 |
| 95% H-UCL (Log ROS) | 1.985 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.471 | KM Geo Mean | 0.624 |
| KM SD (logged) | 1.044 | 95% Critical H Value (KM-Log) | 2.522 |
| KM Standard Error of Mean (logged) | 0.199 | 95% H-UCL (KM -Log) | 1.77 |
| KM SD (logged) | 1.044 | 95% Critical H Value (KM-Log) | 2.522 |
| KM Standard Error of Mean (logged) | 0.199 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.074 | Mean in Log Scale | -0.531 |
| SD in Original Scale | 1.252 | SD in Log Scale | 1.149 |
| 95% t UCL (Assumes normality) | 1.47 | 95% H-Stat UCL | 2.024 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Gamma Distributed at 5% Significance Level

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Adjusted Gamma UCL | 1.656 | 95% GROS Adjusted Gamma UCL | 1.714 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

gamma-BHC (Lindane)

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 17 |
| | | Number of Missing Observations | 36 |
| Minimum | 0.79 | Mean | 1.797 |
| Maximum | 4.2 | Median | 1.45 |
| SD | 0.877 | Std. Error of Mean | 0.163 |
| Coefficient of Variation | 0.488 | Skewness | 1.522 |

| Normal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.779 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.292 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

| Assuming Normal Distribution | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 2.074 | 95% Adjusted-CLT UCL (Chen-1995) | 2.114 |
| | | 95% Modified-t UCL (Johnson-1978) | 2.081 |

| Gamma GOF Test | | |
|---|---|---|
| A-D Test Statistic | 1.84 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.747 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.235 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.163 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 5.6 | k star (bias corrected MLE) | 5.044 |
| Theta hat (MLE) | 0.321 | Theta star (bias corrected MLE) | 0.356 |
| nu hat (MLE) | 324.8 | nu star (bias corrected) | 292.5 |
| MLE Mean (bias corrected) | 1.797 | MLE Sd (bias corrected) | 0.8 |
| | | Approximate Chi Square Value (0.05) | 253.9 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 251.8 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 2.07 | 95% Adjusted Gamma UCL (use when n<50) | 2.087 |

| Lognormal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.897 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.204 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.236 | Mean of logged Data | 0.494 |
| Maximum of Logged Data | 1.435 | SD of logged Data | 0.415 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 2.071 | 90% Chebyshev (MVUE) UCL | 2.205 |
| 95% Chebyshev (MVUE) UCL | 2.398 | 97.5% Chebyshev (MVUE) UCL | 2.665 |
| 99% Chebyshev (MVUE) UCL | 3.189 | | |

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 2.064 | 95% Jackknife UCL | 2.074 |
| 95% Standard Bootstrap UCL | 2.058 | 95% Bootstrap-t UCL | 2.138 |
| 95% Hall's Bootstrap UCL | 2.097 | 95% Percentile Bootstrap UCL | 2.08 |
| 95% BCA Bootstrap UCL | 2.121 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2.285 | 95% Chebyshev(Mean, Sd) UCL | 2.506 |
| 97.5% Chebyshev(Mean, Sd) UCL | 2.814 | 99% Chebyshev(Mean, Sd) UCL | 3.417 |

| Suggested UCL to Use | | | |
|---|---|---|---|
| 95% Student's-t UCL | 2.074 | or 95% Modified-t UCL | 2.081 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

HEPTACHLOR EPOXIDE

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 36 |
| Minimum | 1 | Mean | 3.421 |
| Maximum | 7.6 | Median | 2.8 |
| SD | 1.786 | Std. Error of Mean | 0.332 |
| Coefficient of Variation | 0.522 | Skewness | 0.713 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.928 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.153 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 3.985 | 95% Adjusted-CLT UCL (Chen-1995) | 4.013 |
| | | 95% Modified-t UCL (Johnson-1978) | 3.992 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.276 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.099 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.164 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.845 | k star (bias corrected MLE) | 3.47 |
| Theta hat (MLE) | 0.89 | Theta star (bias corrected MLE) | 0.986 |
| nu hat (MLE) | 223 | nu star (bias corrected) | 201.2 |
| MLE Mean (bias corrected) | 3.421 | MLE Sd (bias corrected) | 1.836 |
| | | Approximate Chi Square Value (0.05) | 169.4 |
| Adjusted Level of Significance | 0.0407 | Adjusted Chi Square Value | 167.7 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 4.063 | 95% Adjusted Gamma UCL (use when n<50) | 4.105 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.973 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.926 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0887 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.161 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0 | Mean of logged Data | 1.094 |
| Maximum of Logged Data | 2.028 | SD of logged Data | 0.541 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 4.233 | 90% Chebyshev (MVUE) UCL | 4.526 |
| 95% Chebyshev (MVUE) UCL | 5.019 | 97.5% Chebyshev (MVUE) UCL | 5.703 |
| 99% Chebyshev (MVUE) UCL | 7.046 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 3.966 | 95% Jackknife UCL | 3.985 |
| 95% Standard Bootstrap UCL | 3.963 | 95% Bootstrap-t UCL | 4.067 |
| 95% Hall's Bootstrap UCL | 3.994 | 95% Percentile Bootstrap UCL | 3.966 |
| 95% BCA Bootstrap UCL | 3.959 | | |
| 90% Chebyshev(Mean, Sd) UCL | 4.415 | 95% Chebyshev(Mean, Sd) UCL | 4.866 |
| 97.5% Chebyshev(Mean, Sd) UCL | 5.492 | 99% Chebyshev(Mean, Sd) UCL | 6.72 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 3.985 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

Total LMW PAHs

General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 27 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 37 |
| Number of Detects | 11 | Number of Non-Detects | 16 |
| Number of Distinct Detects | 10 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 8.6 | Minimum Non-Detect | 11 |
| Maximum Detect | 41 | Maximum Non-Detect | 11 |
| Variance Detects | 133.6 | Percent Non-Detects | 59.26% |
| Mean Detects | 21.75 | SD Detects | 11.56 |
| Median Detects | 22 | CV Detects | 0.531 |
| Skewness Detects | 0.551 | Kurtosis Detects | -0.75 |
| Mean of Logged Detects | 2.941 | SD of Logged Detects | 0.567 |

Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.907 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.164 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 13.99 | KM Standard Error of Mean | 1.925 |
| KM SD | 9.536 | 95% KM (BCA) UCL | 17.89 |
| 95% KM (t) UCL | 17.27 | 95% KM (Percentile Bootstrap) UCL | 17.63 |
| 95% KM (z) UCL | 17.16 | 95% KM Bootstrap t UCL | 18.32 |
| 90% KM Chebyshev UCL | 19.76 | 95% KM Chebyshev UCL | 22.38 |
| 97.5% KM Chebyshev UCL | 26.01 | 99% KM Chebyshev UCL | 33.14 |

Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.344 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.733 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.172 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.257 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.763 | k star (bias corrected MLE) | 2.798 |
| Theta hat (MLE) | 5.781 | Theta star (bias corrected MLE) | 7.776 |
| nu hat (MLE) | 82.79 | nu star (bias corrected) | 61.55 |
| Mean (detects) | 21.75 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 12.15 |
| Maximum | 41 | Median | 8.995 |
| SD | 11.45 | CV | 0.942 |
| k hat (MLE) | 0.529 | k star (bias corrected MLE) | 0.495 |
| Theta hat (MLE) | 22.95 | Theta star (bias corrected MLE) | 24.53 |
| nu hat (MLE) | 28.58 | nu star (bias corrected) | 26.74 |
| Adjusted Level of Significance (β) | 0.0401 | | |
| Approximate Chi Square Value (26.74, α) | 15.95 | Adjusted Chi Square Value (26.74, β) | 15.41 |
| 95% Gamma Approximate UCL (use when n>=50) | 20.36 | 95% Gamma Adjusted UCL (use when n<50) | 21.07 |

Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 13.99 | SD (KM) | 9.536 |
| Variance (KM) | 90.94 | SE of Mean (KM) | 1.925 |
| k hat (KM) | 2.152 | k star (KM) | 1.938 |
| nu hat (KM) | 116.2 | nu star (KM) | 104.6 |
| theta hat (KM) | 6.501 | theta star (KM) | 7.22 |
| 80% gamma percentile (KM) | 21.02 | 90% gamma percentile (KM) | 27.41 |
| 95% gamma percentile (KM) | 33.52 | 99% gamma percentile (KM) | 47.09 |

Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (104.63, α) | 82.02 | Adjusted Chi Square Value (104.63, β) | 80.74 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 17.84 | 95% Gamma Adjusted KM-UCL (use when n<50) | 18.13 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.921 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.153 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.251 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 13.69 | Mean in Log Scale | 2.392 |
| SD in Original Scale | 10.19 | SD in Log Scale | 0.671 |
| 95% t UCL (assumes normality of ROS data) | 17.03 | 95% Percentile Bootstrap UCL | 17.11 |
| 95% BCA Bootstrap UCL | 17.4 | 95% Bootstrap t UCL | 18.15 |
| 95% H-UCL (Log ROS) | 18.12 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | 2.477 | KM Geo Mean | 11.9 |
| KM SD (logged) | 0.517 | 95% Critical H Value (KM-Log) | 1.985 |
| KM Standard Error of Mean (logged) | 0.104 | 95% H-UCL (KM -Log) | 16.64 |
| KM SD (logged) | 0.517 | 95% Critical H Value (KM-Log) | 1.985 |
| KM Standard Error of Mean (logged) | 0.104 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 12.12 | Mean in Log Scale | 2.208 |
| SD in Original Scale | 10.85 | SD in Log Scale | 0.712 |
| 95% t UCL (Assumes normality) | 15.68 | 95% H-Stat UCL | 15.88 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 17.27

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fish Tissue

TCDD-TEQ (Bird)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 28 |
| | | Number of Missing Observations | 37 |
| Minimum | 2.0000E-4 | Mean | 0.00116 |
| Maximum | 0.00584 | Median | 8.8416E-4 |
| SD | 0.00116 | Std. Error of Mean | 2.1869E-4 |
| Coefficient of Variation | 1 | Skewness | 2.915 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.674 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.236 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.00153 | 95% Adjusted-CLT UCL (Chen-1995) | 0.00165 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.00155 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.739 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.76 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.158 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.168 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.785 | k star (bias corrected MLE) | 1.617 |
| Theta hat (MLE) | 6.4843E-4 | Theta star (bias corrected MLE) | 7.1555E-4 |
| nu hat (MLE) | 99.93 | nu star (bias corrected) | 90.56 |
| MLE Mean (bias corrected) | 0.00116 | MLE Sd (bias corrected) | 9.0994E-4 |
| | | Approximate Chi Square Value (0.05) | 69.62 |
| Adjusted Level of Significance | 0.0404 | Adjusted Chi Square Value | 68.48 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.00151 | 95% Adjusted Gamma UCL (use when n<50) | 0.00153 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.978 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0998 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -8.517 | Mean of logged Data | -7.067 |
| Maximum of Logged Data | -5.143 | SD of logged Data | 0.753 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.00155 | 90% Chebyshev (MVUE) UCL | 0.00164 |
| 95% Chebyshev (MVUE) UCL | 0.00187 | 97.5% Chebyshev (MVUE) UCL | 0.0022 |
| 99% Chebyshev (MVUE) UCL | 0.00284 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.00152 | 95% Jackknife UCL | 0.00153 |
| 95% Standard Bootstrap UCL | 0.00151 | 95% Bootstrap-t UCL | 0.00182 |
| 95% Hall's Bootstrap UCL | 0.00328 | 95% Percentile Bootstrap UCL | 0.00154 |
| 95% BCA Bootstrap UCL | 0.00165 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.00181 | 95% Chebyshev(Mean, Sd) UCL | 0.00211 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.00252 | 99% Chebyshev(Mean, Sd) UCL | 0.00333 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Adjusted Gamma UCL | 0.00153 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Fish Tissue

### TCDD-TEQ (Mammal)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 28 | Number of Distinct Observations | 28 |
| | | Number of Missing Observations | 37 |
| Minimum | 1.5000E-4 | Mean | 7.2652E-4 |
| Maximum | 0.00334 | Median | 4.7795E-4 |
| SD | 6.6831E-4 | Std. Error of Mean | 1.2630E-4 |
| Coefficient of Variation | 0.92 | Skewness | 2.562 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.723 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.225 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 9.4164E-4 | 95% Adjusted-CLT UCL (Chen-1995) | 9.9960E-4 |
| | | 95% Modified-t UCL (Johnson-1978) | 9.5183E-4 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.775 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.759 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.167 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.168 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.932 | k star (bias corrected MLE) | 1.749 |
| Theta hat (MLE) | 3.7605E-4 | Theta star (bias corrected MLE) | 4.1544E-4 |
| nu hat (MLE) | 108.2 | nu star (bias corrected) | 97.93 |
| MLE Mean (bias corrected) | 7.2652E-4 | MLE Sd (bias corrected) | 5.4939E-4 |
| | | Approximate Chi Square Value (0.05) | 76.1 |
| Adjusted Level of Significance | 0.0404 | Adjusted Chi Square Value | 74.91 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 9.3490E-4 | 95% Adjusted Gamma UCL (use when n<50) | 9.4974E-4 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.974 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.924 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.123 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.164 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -8.805 | Mean of logged Data | -7.508 |
| Maximum of Logged Data | -5.703 | SD of logged Data | 0.724 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 9.6232E-4 | 90% Chebyshev (MVUE) UCL | 0.00102 |
| 95% Chebyshev (MVUE) UCL | 0.00116 | 97.5% Chebyshev (MVUE) UCL | 0.00136 |
| 99% Chebyshev (MVUE) UCL | 0.00175 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 9.3426E-4 | 95% Jackknife UCL | 9.4164E-4 |
| 95% Standard Bootstrap UCL | 9.2347E-4 | 95% Bootstrap-t UCL | 0.00107 |
| 95% Hall's Bootstrap UCL | 0.00135 | 95% Percentile Bootstrap UCL | 9.4230E-4 |
| 95% BCA Bootstrap UCL | 0.001 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.00111 | 95% Chebyshev(Mean, Sd) UCL | 0.00128 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.00152 | 99% Chebyshev(Mean, Sd) UCL | 0.00198 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Adjusted Gamma UCL | 9.4974E-4 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

HEPTACHLOR

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 29 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 36 |
| Number of Detects | 11 | Number of Non-Detects | 18 |
| Number of Distinct Detects | 10 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 0.37 | Minimum Non-Detect | 0.091 |
| Maximum Detect | 2.7 | Maximum Non-Detect | 0.14 |
| Variance Detects | 0.344 | Percent Non-Detects | 62.07% |
| Mean Detects | 1.277 | SD Detects | 0.586 |
| Median Detects | 1.2 | CV Detects | 0.459 |
| Skewness Detects | 1.255 | Kurtosis Detects | 3.324 |
| Mean of Logged Detects | 0.146 | SD of Logged Detects | 0.49 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.883 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.2 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Detected Data appear Normal at 5% Significance Level |

**Detected Data appear Normal at 5% Significance Level**

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.541 | KM Standard Error of Mean | 0.131 |
| KM SD | 0.671 | 95% KM (BCA) UCL | 0.797 |
| 95% KM (t) UCL | 0.763 | 95% KM (Percentile Bootstrap) UCL | 0.749 |
| 95% KM (z) UCL | 0.756 | 95% KM Bootstrap t UCL | 0.788 |
| 90% KM Chebyshev UCL | 0.933 | 95% KM Chebyshev UCL | 1.11 |
| 97.5% KM Chebyshev UCL | 1.357 | 99% KM Chebyshev UCL | 1.841 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.455 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.731 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.205 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.256 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.204 | k star (bias corrected MLE) | 3.845 |
| Theta hat (MLE) | 0.245 | Theta star (bias corrected MLE) | 0.332 |
| nu hat (MLE) | 114.5 | nu star (bias corrected) | 84.6 |
| Mean (detects) | 1.277 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.536 |
| Maximum | 2.7 | Median | 0.143 |
| SD | 0.694 | CV | 1.295 |
| k hat (MLE) | 0.426 | k star (bias corrected MLE) | 0.405 |
| Theta hat (MLE) | 1.256 | Theta star (bias corrected MLE) | 1.322 |
| nu hat (MLE) | 24.73 | nu star (bias corrected) | 23.51 |
| Adjusted Level of Significance (β) | 0.0407 | | |
| Approximate Chi Square Value (23.51, α) | 13.47 | Adjusted Chi Square Value (23.51, β) | 13.02 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.934 | 95% Gamma Adjusted UCL (use when n<50) | 0.967 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.541 | SD (KM) | 0.671 |
| Variance (KM) | 0.45 | SE of Mean (KM) | 0.131 |
| k hat (KM) | 0.651 | k star (KM) | 0.606 |
| nu hat (KM) | 37.73 | nu star (KM) | 35.16 |
| theta hat (KM) | 0.832 | theta star (KM) | 0.892 |
| 80% gamma percentile (KM) | 0.892 | 90% gamma percentile (KM) | 1.404 |
| 95% gamma percentile (KM) | 1.939 | 99% gamma percentile (KM) | 3.234 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (35.16, α) | 22.59 | Adjusted Chi Square Value (35.16, β) | 21.99 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.842 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.865 |

**Lognormal GOF Test on Detected Observations Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.901 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.85 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.237 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.251 | Detected Data appear Lognormal at 5% Significance Level | |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.675 | Mean in Log Scale | -0.737 |
| SD in Original Scale | 0.602 | SD in Log Scale | 0.845 |
| 95% t UCL (assumes normality of ROS data) | 0.865 | 95% Percentile Bootstrap UCL | 0.873 |
| 95% BCA Bootstrap UCL | 0.9 | 95% Bootstrap t UCL | 0.926 |
| 95% H-UCL (Log ROS) | 0.985 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -1.433 | KM Geo Mean | 0.239 |
| KM SD (logged) | 1.267 | 95% Critical H Value (KM-Log) | 2.816 |
| KM Standard Error of Mean (logged) | 0.247 | 95% H-UCL (KM -Log) | 1.045 |
| KM SD (logged) | 1.267 | 95% Critical H Value (KM-Log) | 2.816 |
| KM Standard Error of Mean (logged) | 0.247 | | |

**DL/2 Statistics**

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.514 | Mean in Log Scale | -1.837 |
| SD in Original Scale | 0.701 | SD in Log Scale | 1.606 |
| 95% t UCL (Assumes normality) | 0.736 | 95% H-Stat UCL | 1.578 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Normal Distributed at 5% Significance Level**

**Suggested UCL to Use**

95% KM (t) UCL 0.763

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.17/31/2018 1:08:40 PM |
| From File | ERA_Bethic_ProUCL_Input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

**Chromium**

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 13 |
| Minimum | 0.34 | Mean | 2.121 |
| Maximum | 5.1 | Median | 1.8 |
| SD | 1.621 | Std. Error of Mean | 0.45 |
| Coefficient of Variation | 0.765 | Skewness | 0.844 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.884 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.17 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 2.922 | 95% Adjusted-CLT UCL (Chen-1995) | 2.973 |
| | | 95% Modified-t UCL (Johnson-1978) | 2.94 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.365 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.748 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.145 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.241 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.635 | k star (bias corrected MLE) | 1.309 |
| Theta hat (MLE) | 1.297 | Theta star (bias corrected MLE) | 1.62 |
| nu hat (MLE) | 42.51 | nu star (bias corrected) | 34.03 |
| MLE Mean (bias corrected) | 2.121 | MLE Sd (bias corrected) | 1.854 |
| | | Approximate Chi Square Value (0.05) | 21.69 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 20.3 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 3.328 | 95% Adjusted Gamma UCL (use when n<50) | 3.556 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.914 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.188 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.079 | Mean of logged Data | 0.416 |
| Maximum of Logged Data | 1.629 | SD of logged Data | 0.926 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 4.819 | 90% Chebyshev (MVUE) UCL | 4.066 |
| 95% Chebyshev (MVUE) UCL | 4.899 | 97.5% Chebyshev (MVUE) UCL | 6.055 |
| 99% Chebyshev (MVUE) UCL | 8.325 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 2.86 | 95% Jackknife UCL | 2.922 |
| 95% Standard Bootstrap UCL | 2.828 | 95% Bootstrap-t UCL | 3.142 |
| 95% Hall's Bootstrap UCL | 3.301 | 95% Percentile Bootstrap UCL | 2.856 |
| 95% BCA Bootstrap UCL | 2.902 | | |
| 90% Chebyshev(Mean, Sd) UCL | 3.47 | 95% Chebyshev(Mean, Sd) UCL | 4.081 |
| 97.5% Chebyshev(Mean, Sd) UCL | 4.929 | 99% Chebyshev(Mean, Sd) UCL | 6.595 |

**Suggested UCL to Use**

95% Student's-t UCL 2.922

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

Endosulfan II

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 26 |
| Number of Detects | 3 | Number of Non-Detects | 9 |
| Number of Distinct Detects | 3 | Number of Distinct Non-Detects | 7 |
| Minimum Detect | 0.46 | Minimum Non-Detect | 0.071 |
| Maximum Detect | 0.62 | Maximum Non-Detect | 0.64 |
| Variance Detects | 0.00803 | Percent Non-Detects | 75% |
| Mean Detects | 0.563 | SD Detects | 0.0896 |
| Median Detects | 0.61 | CV Detects | 0.159 |
| Skewness Detects | -1.708 | Kurtosis Detects | N/A |
| Mean of Logged Detects | -0.583 | SD of Logged Detects | 0.168 |

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

| Normal GOF Test on Detects Only | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.797 | Shapiro Wilk GOF Test | |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.365 | Lilliefors GOF Test | |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Normal at 5% Significance Level | |

Detected Data appear Normal at 5% Significance Level

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.205 | KM Standard Error of Mean | 0.0822 |
| KM SD | 0.223 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 0.353 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 0.34 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 0.452 | 95% KM Chebyshev UCL | 0.564 |
| 97.5% KM Chebyshev UCL | 0.719 | 99% KM Chebyshev UCL | 1.023 |

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 55.29 | k star (bias corrected MLE) | N/A |
| Theta hat (MLE) | 0.0102 | Theta star (bias corrected MLE) | N/A |
| nu hat (MLE) | 331.8 | nu star (bias corrected) | N/A |
| Mean (detects) | 0.563 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.143 | Mean | 0.333 |
| Maximum | 0.62 | Median | 0.25 |
| SD | 0.151 | CV | 0.454 |
| k hat (MLE) | 6.035 | k star (bias corrected MLE) | 4.582 |
| Theta hat (MLE) | 0.0552 | Theta star (bias corrected MLE) | 0.0727 |
| nu hat (MLE) | 144.8 | nu star (bias corrected) | 110 |
| Adjusted Level of Significance (β) | 0.029 | | |
| Approximate Chi Square Value (109.96, α) | 86.76 | Adjusted Chi Square Value (109.96, β) | 83.61 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.422 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.205 | SD (KM) | 0.223 |
| Variance (KM) | 0.0495 | SE of Mean (KM) | 0.0822 |
| k hat (KM) | 0.851 | k star (KM) | 0.693 |
| nu hat (KM) | 20.41 | nu star (KM) | 16.64 |
| theta hat (KM) | 0.241 | theta star (KM) | 0.296 |
| 80% gamma percentile (KM) | 0.338 | 90% gamma percentile (KM) | 0.516 |
| 95% gamma percentile (KM) | 0.701 | 99% gamma percentile (KM) | 1.142 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (16.64, α) | 8.418 | Adjusted Chi Square Value (16.64, β) | 7.541 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.406 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.453 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.791 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.368 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.369 | Mean in Log Scale | -1.043 |
| SD in Original Scale | 0.127 | SD in Log Scale | 0.304 |
| 95% t UCL (assumes normality of ROS data) | 0.435 | 95% Percentile Bootstrap UCL | 0.427 |
| 95% BCA Bootstrap UCL | 0.441 | 95% Bootstrap t UCL | 0.486 |
| 95% H-UCL (Log ROS) | 0.441 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.083 | KM Geo Mean | 0.125 |
| KM SD (logged) | 0.921 | 95% Critical H Value (KM-Log) | 2.775 |
| KM Standard Error of Mean (logged) | 0.34 | 95% H-UCL (KM -Log) | 0.412 |
| KM SD (logged) | 0.921 | 95% Critical H Value (KM-Log) | 2.775 |
| KM Standard Error of Mean (logged) | 0.34 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.206 | Mean in Log Scale | -2.232 |
| SD in Original Scale | 0.233 | SD in Log Scale | 1.198 |
| 95% t UCL (Assumes normality) | 0.327 | 95% H-Stat UCL | 0.721 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.353

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Arsenic**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 13 |
| Minimum | 0.32 | Mean | 0.729 |
| Maximum | 1.1 | Median | 0.78 |
| SD | 0.196 | Std. Error of Mean | 0.0542 |
| Coefficient of Variation | 0.268 | Skewness | -0.483 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.938 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.17 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.826 | 95% Adjusted-CLT UCL (Chen-1995) | 0.811 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.825 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.692 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.734 | Detected data appear Gamma Distributed at 5% Significance Level |

| | | | | |
|---|---|---|---|---|
| K-S Test Statistic | 0.208 | | Kolmogorov-Smirnov Gamma GOF Test | |
| 5% K-S Critical Value | 0.237 | | Detected data appear Gamma Distributed at 5% Significance Level | |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 12.41 | k star (bias corrected MLE) | 9.601 |
| Theta hat (MLE) | 0.0587 | Theta star (bias corrected MLE) | 0.076 |
| nu hat (MLE) | 322.8 | nu star (bias corrected) | 249.6 |
| MLE Mean (bias corrected) | 0.729 | MLE Sd (bias corrected) | 0.235 |
| | | Approximate Chi Square Value (0.05) | 214 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 209.3 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.85 | 95% Adjusted Gamma UCL (use when n<50) | 0.87 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.859 | Shapiro Wilk Lognormal GOF Test |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.235 | Lilliefors Lognormal GOF Test |
| 5% Lilliefors Critical Value | 0.234 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.139 | Mean of logged Data | -0.357 |
| Maximum of Logged Data | 0.0953 | SD of logged Data | 0.316 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.877 | 90% Chebyshev (MVUE) UCL | 0.928 |
| 95% Chebyshev (MVUE) UCL | 1.017 | 97.5% Chebyshev (MVUE) UCL | 1.139 |
| 99% Chebyshev (MVUE) UCL | 1.38 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.818 | 95% Jackknife UCL | 0.826 |
| 95% Standard Bootstrap UCL | 0.813 | 95% Bootstrap-t UCL | 0.818 |
| 95% Hall's Bootstrap UCL | 0.817 | 95% Percentile Bootstrap UCL | 0.812 |
| 95% BCA Bootstrap UCL | 0.805 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.892 | 95% Chebyshev(Mean, Sd) UCL | 0.966 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.068 | 99% Chebyshev(Mean, Sd) UCL | 1.269 |

**Suggested UCL to Use**

95% Student's-t UCL 0.826

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Benthic Invertebrate Tissue

Cadmium

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 13 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 13 |
| Minimum | 0.017 | Mean | 0.0753 |
| Maximum | 0.13 | Median | 0.066 |
| SD | 0.0376 | Std. Error of Mean | 0.0104 |
| Coefficient of Variation | 0.499 | Skewness | -0.00436 |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.927 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.182 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.234 | Data appear Normal at 5% Significance Level | |
| Data appear Normal at 5% Significance Level | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.0938 | 95% Adjusted-CLT UCL (Chen-1995) | 0.0924 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.0938 |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.507 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.739 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.157 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.238 | Detected data appear Gamma Distributed at 5% Significance Level | |
| Detected data appear Gamma Distributed at 5% Significance Level | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 3.325 | k star (bias corrected MLE) | 2.609 |
| Theta hat (MLE) | 0.0226 | Theta star (bias corrected MLE) | 0.0289 |
| nu hat (MLE) | 86.45 | nu star (bias corrected) | 67.83 |
| MLE Mean (bias corrected) | 0.0753 | MLE Sd (bias corrected) | 0.0466 |
| | | Approximate Chi Square Value (0.05) | 49.88 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 47.69 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 0.102 | 95% Adjusted Gamma UCL (use when n<50) | 0.107 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.868 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.201 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level | |
| Data appear Lognormal at 5% Significance Level | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | -4.075 | Mean of logged Data | -2.745 |
| Maximum of Logged Data | -2.04 | SD of logged Data | 0.647 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 0.122 | 90% Chebyshev (MVUE) UCL | 0.121 |
| 95% Chebyshev (MVUE) UCL | 0.141 | 97.5% Chebyshev (MVUE) UCL | 0.168 |
| 99% Chebyshev (MVUE) UCL | 0.222 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| Data appear to follow a Discernible Distribution at 5% Significance Level | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 0.0924 | 95% Jackknife UCL | 0.0938 |
| 95% Standard Bootstrap UCL | 0.0914 | 95% Bootstrap-t UCL | 0.0943 |
| 95% Hall's Bootstrap UCL | 0.092 | 95% Percentile Bootstrap UCL | 0.0923 |
| 95% BCA Bootstrap UCL | 0.0923 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.107 | 95% Chebyshev(Mean, Sd) UCL | 0.121 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.14 | 99% Chebyshev(Mean, Sd) UCL | 0.179 |

**Suggested UCL to Use**

95% Student's-t UCL 0.0938

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

## Copper

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 13 |
| Minimum | 9.2 | Mean | 45.75 |
| Maximum | 110 | Median | 39 |
| SD | 34.41 | Std. Error of Mean | 9.543 |
| Coefficient of Variation | 0.752 | Skewness | 0.899 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.877 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.144 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

### Assuming Normal Distribution

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 62.76 | 95% Adjusted-CLT UCL (Chen-1995) | 63.99 |
| | | 95% Modified-t UCL (Johnson-1978) | 63.15 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.329 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.746 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.149 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.24 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.81 | k star (bias corrected MLE) | 1.444 |
| Theta hat (MLE) | 25.27 | Theta star (bias corrected MLE) | 31.69 |
| nu hat (MLE) | 47.06 | nu star (bias corrected) | 37.53 |
| MLE Mean (bias corrected) | 45.75 | MLE Sd (bias corrected) | 38.07 |
| | | Approximate Chi Square Value (0.05) | 24.51 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 23.01 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 70.06 | 95% Adjusted Gamma UCL (use when n<50) | 74.61 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.928 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.146 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.219 | Mean of logged Data | 3.522 |
| Maximum of Logged Data | 4.7 | SD of logged Data | 0.853 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 92.53 | 90% Chebyshev (MVUE) UCL | 82.5 |
| 95% Chebyshev (MVUE) UCL | 98.58 | 97.5% Chebyshev (MVUE) UCL | 120.9 |
| 99% Chebyshev (MVUE) UCL | 164.7 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 61.44 | 95% Jackknife UCL | 62.76 |
| 95% Standard Bootstrap UCL | 60.94 | 95% Bootstrap-t UCL | 67.12 |
| 95% Hall's Bootstrap UCL | 69.74 | 95% Percentile Bootstrap UCL | 61.55 |
| 95% BCA Bootstrap UCL | 64.95 | | |
| 90% Chebyshev(Mean, Sd) UCL | 74.38 | 95% Chebyshev(Mean, Sd) UCL | 87.34 |
| 97.5% Chebyshev(Mean, Sd) UCL | 105.3 | 99% Chebyshev(Mean, Sd) UCL | 140.7 |

**Suggested UCL to Use**

95% Student's-t UCL 62.76

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

Lead

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 13 |
| Minimum | 0.26 | Mean | 1.668 |
| Maximum | 4.8 | Median | 1.2 |
| SD | 1.498 | Std. Error of Mean | 0.416 |
| Coefficient of Variation | 0.899 | Skewness | 0.796 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.859 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.249 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 2.408 | 95% Adjusted-CLT UCL (Chen-1995) | 2.449 |
| | | 95% Modified-t UCL (Johnson-1978) | 2.424 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.734 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.755 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.251 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.242 | Data Not Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.179 | k star (bias corrected MLE) | 0.958 |
| Theta hat (MLE) | 1.414 | Theta star (bias corrected MLE) | 1.74 |
| nu hat (MLE) | 30.66 | nu star (bias corrected) | 24.92 |
| MLE Mean (bias corrected) | 1.668 | MLE Sd (bias corrected) | 1.704 |
| | | Approximate Chi Square Value (0.05) | 14.55 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 13.43 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 2.856 | 95% Adjusted Gamma UCL (use when n<50) | 3.094 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.872 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.227 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.347 | Mean of logged Data | 0.0308 |
| Maximum of Logged Data | 1.569 | SD of logged Data | 1.087 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 4.778 | 90% Chebyshev (MVUE) UCL | 3.461 |
| 95% Chebyshev (MVUE) UCL | 4.238 | 97.5% Chebyshev (MVUE) UCL | 5.316 |
| 99% Chebyshev (MVUE) UCL | 7.434 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 2.351 | 95% Jackknife UCL | 2.408 |
| 95% Standard Bootstrap UCL | 2.327 | 95% Bootstrap-t UCL | 2.528 |
| 95% Hall's Bootstrap UCL | 2.404 | 95% Percentile Bootstrap UCL | 2.346 |
| 95% BCA Bootstrap UCL | 2.428 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2.915 | 95% Chebyshev(Mean, Sd) UCL | 3.479 |
| 97.5% Chebyshev(Mean, Sd) UCL | 4.263 | 99% Chebyshev(Mean, Sd) UCL | 5.803 |

Suggested UCL to Use

95% Adjusted Gamma UCL 3.094

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

Mercury

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 16 |
| Number of Detects | 5 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 5 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 0.041 | Minimum Non-Detect | 0.031 |
| Maximum Detect | 0.072 | Maximum Non-Detect | 0.05 |
| Variance Detects | 1.4250E-4 | Percent Non-Detects | 50% |
| Mean Detects | 0.053 | SD Detects | 0.0119 |
| Median Detects | 0.053 | CV Detects | 0.225 |
| Skewness Detects | 1.132 | Kurtosis Detects | 1.551 |
| Mean of Logged Detects | -2.957 | SD of Logged Detects | 0.215 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.91 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk Critical Value | 0.762 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.267 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.343 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.0424 | KM Standard Error of Mean | 0.00472 |
| KM SD | 0.0132 | 95% KM (BCA) UCL | 0.0508 |
| 95% KM (t) UCL | 0.051 | 95% KM (Percentile Bootstrap) UCL | 0.0501 |
| 95% KM (z) UCL | 0.0502 | 95% KM Bootstrap t UCL | 0.0485 |
| 90% KM Chebyshev UCL | 0.0565 | 95% KM Chebyshev UCL | 0.063 |
| 97.5% KM Chebyshev UCL | 0.0718 | 99% KM Chebyshev UCL | 0.0893 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.302 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.679 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.236 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.357 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 26.4 | k star (bias corrected MLE) | 10.69 |
| Theta hat (MLE) | 0.00201 | Theta star (bias corrected MLE) | 0.00496 |
| nu hat (MLE) | 264 | nu star (bias corrected) | 106.9 |
| Mean (detects) | 0.053 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.0195 | Mean | 0.0392 |
| Maximum | 0.072 | Median | 0.0358 |
| SD | 0.0168 | CV | 0.428 |
| k hat (MLE) | 6.341 | k star (bias corrected MLE) | 4.505 |
| Theta hat (MLE) | 0.00619 | Theta star (bias corrected MLE) | 0.00871 |
| nu hat (MLE) | 126.8 | nu star (bias corrected) | 90.11 |
| Adjusted Level of Significance (β) | 0.0267 | | |
| Approximate Chi Square Value (90.11, α) | 69.22 | Adjusted Chi Square Value (90.11, β) | 66.05 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.0511 | 95% Gamma Adjusted UCL (use when n<50) | 0.0535 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.0424 | SD (KM) | 0.0132 |
| Variance (KM) | 1.7397E-4 | SE of Mean (KM) | 0.00472 |
| k hat (KM) | 10.33 | k star (KM) | 7.3 |
| nu hat (KM) | 206.7 | nu star (KM) | 146 |
| theta hat (KM) | 0.0041 | theta star (KM) | 0.00581 |
| 80% gamma percentile (KM) | 0.0547 | 90% gamma percentile (KM) | 0.0633 |
| 95% gamma percentile (KM) | 0.0711 | 99% gamma percentile (KM) | 0.0871 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (146.00, α) | 119.1 | Adjusted Chi Square Value (146.00, β) | 114.9 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.052 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.0539 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.945 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.762 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.23 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.343 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0416 | Mean in Log Scale | -3.229 |
| SD in Original Scale | 0.0145 | SD in Log Scale | 0.328 |
| 95% t UCL (assumes normality of ROS data) | 0.05 | 95% Percentile Bootstrap UCL | 0.0489 |
| 95% BCA Bootstrap UCL | 0.05 | 95% Bootstrap t UCL | 0.0534 |
| 95% H-UCL (Log ROS) | 0.052 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -3.204 | KM Geo Mean | 0.0406 |
| KM SD (logged) | 0.289 | 95% Critical H Value (KM-Log) | 1.965 |
| KM Standard Error of Mean (logged) | 0.104 | 95% H-UCL (KM -Log) | 0.0511 |
| KM SD (logged) | 0.289 | 95% Critical H Value (KM-Log) | 1.965 |
| KM Standard Error of Mean (logged) | 0.104 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.0357 | Mean in Log Scale | -3.486 |
| SD in Original Scale | 0.0201 | SD in Log Scale | 0.591 |
| 95% t UCL (Assumes normality) | 0.0473 | 95% H-Stat UCL | 0.0579 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.051

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

Nickel

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 13 |
| | | Number of Missing Observations | 13 |
| Minimum | 0.51 | Mean | 1.4 |
| Maximum | 3.3 | Median | 0.93 |
| SD | 0.874 | Std. Error of Mean | 0.242 |
| Coefficient of Variation | 0.624 | Skewness | 1.047 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.872 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.243 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data Not Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.832 | 95% Adjusted-CLT UCL (Chen-1995) | 1.874 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.844 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.428 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.739 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.223 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.238 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.112 | k star (bias corrected MLE) | 2.445 |
| Theta hat (MLE) | 0.45 | Theta star (bias corrected MLE) | 0.573 |
| nu hat (MLE) | 80.9 | nu star (bias corrected) | 63.56 |
| MLE Mean (bias corrected) | 1.4 | MLE Sd (bias corrected) | 0.895 |
| | | Approximate Chi Square Value (0.05) | 46.22 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 44.12 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.925 | 95% Adjusted Gamma UCL (use when n<50) | 2.017 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.194 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.673 | Mean of logged Data | 0.167 |
| Maximum of Logged Data | 1.194 | SD of logged Data | 0.6 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 2.084 | 90% Chebyshev (MVUE) UCL | 2.114 |
| 95% Chebyshev (MVUE) UCL | 2.44 | 97.5% Chebyshev (MVUE) UCL | 2.893 |
| 99% Chebyshev (MVUE) UCL | 3.783 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 1.799 | 95% Jackknife UCL | 1.832 |
| 95% Standard Bootstrap UCL | 1.778 | 95% Bootstrap-t UCL | 1.944 |
| 95% Hall's Bootstrap UCL | 1.852 | 95% Percentile Bootstrap UCL | 1.794 |
| 95% BCA Bootstrap UCL | 1.851 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2.127 | 95% Chebyshev(Mean, Sd) UCL | 2.456 |
| 97.5% Chebyshev(Mean, Sd) UCL | 2.913 | 99% Chebyshev(Mean, Sd) UCL | 3.811 |

**Suggested UCL to Use**

95% Student's-t UCL 1.832

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

Selenium

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 13 |
| Number of Detects | 12 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 11 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.14 | Minimum Non-Detect | 0.46 |
| Maximum Detect | 0.69 | Maximum Non-Detect | 0.46 |
| Variance Detects | 0.0288 | Percent Non-Detects | 7.692% |
| Mean Detects | 0.427 | SD Detects | 0.17 |
| Median Detects | 0.44 | CV Detects | 0.398 |
| Skewness Detects | -0.522 | Kurtosis Detects | -0.372 |
| Mean of Logged Detects | -0.953 | SD of Logged Detects | 0.517 |

| Normal GOF Test on Detects Only | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.934 | Shapiro Wilk GOF Test |
| 5% Shapiro Wilk Critical Value | 0.859 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.188 | Lilliefors GOF Test |
| 5% Lilliefors Critical Value | 0.243 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

| Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs | | | |
|---|---|---|---|
| KM Mean | 0.419 | KM Standard Error of Mean | 0.0482 |
| KM SD | 0.162 | 95% KM (BCA) UCL | 0.498 |
| 95% KM (t) UCL | 0.505 | 95% KM (Percentile Bootstrap) UCL | 0.495 |
| 95% KM (z) UCL | 0.498 | 95% KM Bootstrap t UCL | 0.495 |
| 90% KM Chebyshev UCL | 0.563 | 95% KM Chebyshev UCL | 0.629 |
| 97.5% KM Chebyshev UCL | 0.72 | 99% KM Chebyshev UCL | 0.899 |

| Gamma GOF Tests on Detected Observations Only | | |
|---|---|---|
| A-D Test Statistic | 0.721 | Anderson-Darling GOF Test |
| 5% A-D Critical Value | 0.732 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.252 | Kolmogorov-Smirnov GOF |
| 5% K-S Critical Value | 0.246 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

| Gamma Statistics on Detected Data Only | | | |
|---|---|---|---|
| k hat (MLE) | 5.078 | k star (bias corrected MLE) | 3.864 |
| Theta hat (MLE) | 0.084 | Theta star (bias corrected MLE) | 0.11 |
| nu hat (MLE) | 121.9 | nu star (bias corrected) | 92.74 |
| Mean (detects) | 0.427 | | |

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.14 | Mean | 0.418 |
| Maximum | 0.69 | Median | 0.43 |
| SD | 0.165 | CV | 0.395 |
| k hat (MLE) | 5.331 | k star (bias corrected MLE) | 4.152 |
| Theta hat (MLE) | 0.0785 | Theta star (bias corrected MLE) | 0.101 |
| nu hat (MLE) | 138.6 | nu star (bias corrected) | 108 |
| Adjusted Level of Significance (β) | 0.0301 | | |
| Approximate Chi Square Value (107.96, α) | 84.98 | Adjusted Chi Square Value (107.96, β) | 82.08 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.531 | 95% Gamma Adjusted UCL (use when n<50) | 0.55 |

| Estimates of Gamma Parameters using KM Estimates | | | |
|---|---|---|---|
| Mean (KM) | 0.419 | SD (KM) | 0.162 |
| Variance (KM) | 0.0263 | SE of Mean (KM) | 0.0482 |
| k hat (KM) | 6.651 | k star (KM) | 5.167 |
| nu hat (KM) | 172.9 | nu star (KM) | 134.4 |
| theta hat (KM) | 0.0629 | theta star (KM) | 0.081 |
| 80% gamma percentile (KM) | 0.561 | 90% gamma percentile (KM) | 0.665 |
| 95% gamma percentile (KM) | 0.76 | 99% gamma percentile (KM) | 0.961 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (134.35, α) | 108.6 | Adjusted Chi Square Value (134.35, β) | 105.3 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.518 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.534 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.834 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Detected Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.279 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Detected Data Not Lognormal at 5% Significance Level |

Detected Data Not Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.416 | Mean in Log Scale | -0.976 |
| SD in Original Scale | 0.167 | SD in Log Scale | 0.502 |
| 95% t UCL (assumes normality of ROS data) | 0.498 | 95% Percentile Bootstrap UCL | 0.488 |
| 95% BCA Bootstrap UCL | 0.484 | 95% Bootstrap t UCL | 0.492 |
| 95% H-UCL (Log ROS) | 0.581 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.975 | KM Geo Mean | 0.377 |
| KM SD (logged) | 0.499 | 95% Critical H Value (KM-Log) | 2.111 |
| KM Standard Error of Mean (logged) | 0.15 | 95% H-UCL (KM -Log) | 0.579 |
| KM SD (logged) | 0.499 | 95% Critical H Value (KM-Log) | 2.111 |
| KM Standard Error of Mean (logged) | 0.15 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.412 | Mean in Log Scale | -0.993 |
| SD in Original Scale | 0.171 | SD in Log Scale | 0.515 |
| 95% t UCL (Assumes normality) | 0.496 | 95% H-Stat UCL | 0.581 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.505

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Silver

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 13 |
| | | Number of Missing Observations | 13 |
| Minimum | 0.036 | Mean | 0.293 |
| Maximum | 1 | Median | 0.12 |
| SD | 0.298 | Std. Error of Mean | 0.0826 |
| Coefficient of Variation | 1.015 | Skewness | 1.286 |

| Normal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.834 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.258 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

| Assuming Normal Distribution | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.441 | 95% Adjusted-CLT UCL (Chen-1995) | 0.461 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.446 |

| Gamma GOF Test | | |
|---|---|---|
| A-D Test Statistic | 0.45 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.757 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.214 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.243 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 1.056 | k star (bias corrected MLE) | 0.864 |
| Theta hat (MLE) | 0.278 | Theta star (bias corrected MLE) | 0.34 |
| nu hat (MLE) | 27.46 | nu star (bias corrected) | 22.46 |
| MLE Mean (bias corrected) | 0.293 | MLE Sd (bias corrected) | 0.316 |
| | | Approximate Chi Square Value (0.05) | 12.68 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 11.64 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.52 | 95% Adjusted Gamma UCL (use when n<50) | 0.566 |

| Lognormal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.929 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.171 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.324 | Mean of logged Data | -1.769 |
| Maximum of Logged Data | 0 | SD of logged Data | 1.142 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 0.908 | 90% Chebyshev (MVUE) UCL | 0.619 |
| 95% Chebyshev (MVUE) UCL | 0.761 | 97.5% Chebyshev (MVUE) UCL | 0.959 |
| 99% Chebyshev (MVUE) UCL | 1.348 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 0.429 | 95% Jackknife UCL | 0.441 |
| 95% Standard Bootstrap UCL | 0.421 | 95% Bootstrap-t UCL | 0.494 |
| 95% Hall's Bootstrap UCL | 0.481 | 95% Percentile Bootstrap UCL | 0.43 |
| 95% BCA Bootstrap UCL | 0.442 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.541 | 95% Chebyshev(Mean, Sd) UCL | 0.653 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.809 | 99% Chebyshev(Mean, Sd) UCL | 1.115 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Adjusted Gamma UCL | 0.566 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 13 |
| Minimum | 17 | Mean | 45.38 |
| Maximum | 89 | Median | 28 |
| SD | 25.29 | Std. Error of Mean | 7.013 |
| Coefficient of Variation | 0.557 | Skewness | 0.499 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.86 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.293 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 57.88 | 95% Adjusted-CLT UCL (Chen-1995) | 57.96 |
| | | 95% Modified-t UCL (Johnson-1978) | 58.05 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.833 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.738 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.281 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.238 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.494 | k star (bias corrected MLE) | 2.739 |
| Theta hat (MLE) | 12.99 | Theta star (bias corrected MLE) | 16.57 |
| nu hat (MLE) | 90.84 | nu star (bias corrected) | 71.21 |
| MLE Mean (bias corrected) | 45.38 | MLE Sd (bias corrected) | 27.42 |
| | | Approximate Chi Square Value (0.05) | 52.78 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 50.53 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 61.23 | 95% Adjusted Gamma UCL (use when n<50) | 63.96 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.883 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.257 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data Not Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.833 | Mean of logged Data | 3.665 |
| Maximum of Logged Data | 4.489 | SD of logged Data | 0.575 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 66.41 | 90% Chebyshev (MVUE) UCL | 67.88 |
| 95% Chebyshev (MVUE) UCL | 78.04 | 97.5% Chebyshev (MVUE) UCL | 92.16 |
| 99% Chebyshev (MVUE) UCL | 119.9 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 56.92 | 95% Jackknife UCL | 57.88 |
| 95% Standard Bootstrap UCL | 56.4 | 95% Bootstrap-t UCL | 58.38 |
| 95% Hall's Bootstrap UCL | 56.05 | 95% Percentile Bootstrap UCL | 57.08 |
| 95% BCA Bootstrap UCL | 57.54 | | |
| 90% Chebyshev(Mean, Sd) UCL | 66.42 | 95% Chebyshev(Mean, Sd) UCL | 75.95 |
| 97.5% Chebyshev(Mean, Sd) UCL | 89.18 | 99% Chebyshev(Mean, Sd) UCL | 115.2 |

Suggested UCL to Use

| | |
|---|---|
| 95% H-UCL | 66.41 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Benthic Invertebrate Tissue

Total PCBs (Aroclors)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 13 |
| | | Number of Missing Observations | 25 |
| Minimum | 8.9 | Mean | 61.18 |
| Maximum | 226 | Median | 48 |
| SD | 59.12 | Std. Error of Mean | 16.4 |
| Coefficient of Variation | 0.966 | Skewness | 2.014 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.792 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.221 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Normal at 5% Significance Level |

Data appear Approximate Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 90.41 | 95% Adjusted-CLT UCL (Chen-1995) | 97.94 |
| | | 95% Modified-t UCL (Johnson-1978) | 91.93 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.224 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.134 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.241 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.436 | k star (bias corrected MLE) | 1.156 |
| Theta hat (MLE) | 42.6 | Theta star (bias corrected MLE) | 52.92 |
| nu hat (MLE) | 37.34 | nu star (bias corrected) | 30.06 |
| MLE Mean (bias corrected) | 61.18 | MLE Sd (bias corrected) | 56.9 |
| | | Approximate Chi Square Value (0.05) | 18.54 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 17.26 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 99.2 | 95% Adjusted Gamma UCL (use when n<50) | 106.6 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.977 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.14 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.186 | Mean of logged Data | 3.727 |
| Maximum of Logged Data | 5.421 | SD of logged Data | 0.94 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 136.2 | 90% Chebyshev (MVUE) UCL | 113.6 |
| 95% Chebyshev (MVUE) UCL | 137.1 | 97.5% Chebyshev (MVUE) UCL | 169.7 |
| 99% Chebyshev (MVUE) UCL | 233.7 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 88.15 | 95% Jackknife UCL | 90.41 |
| 95% Standard Bootstrap UCL | 87 | 95% Bootstrap-t UCL | 109.7 |
| 95% Hall's Bootstrap UCL | 216.9 | 95% Percentile Bootstrap UCL | 88.26 |
| 95% BCA Bootstrap UCL | 97.96 | | |
| 90% Chebyshev(Mean, Sd) UCL | 110.4 | 95% Chebyshev(Mean, Sd) UCL | 132.7 |
| 97.5% Chebyshev(Mean, Sd) UCL | 163.6 | 99% Chebyshev(Mean, Sd) UCL | 224.3 |

| | Suggested UCL to Use |
|---|---|
| 95% Student's-t UCL | 90.41 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

4,4'-DDD

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 26 |
| Number of Detects | 10 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 9 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.38 | Minimum Non-Detect | 0.098 |
| Maximum Detect | 3.7 | Maximum Non-Detect | 0.21 |
| Variance Detects | 1.151 | Percent Non-Detects | 16.67% |
| Mean Detects | 1.662 | SD Detects | 1.073 |
| Median Detects | 1.35 | CV Detects | 0.646 |
| Skewness Detects | 0.759 | Kurtosis Detects | -0.239 |
| Mean of Logged Detects | 0.294 | SD of Logged Detects | 0.728 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.935 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.167 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 1.401 | KM Standard Error of Mean | 0.334 |
| KM SD | 1.097 | 95% KM (BCA) UCL | 2.021 |
| 95% KM (t) UCL | 2.001 | 95% KM (Percentile Bootstrap) UCL | 1.957 |
| 95% KM (z) UCL | 1.95 | 95% KM Bootstrap t UCL | 2.15 |
| 90% KM Chebyshev UCL | 2.403 | 95% KM Chebyshev UCL | 2.856 |
| 97.5% KM Chebyshev UCL | 3.486 | 99% KM Chebyshev UCL | 4.722 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.167 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.734 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.115 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.269 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.493 | k star (bias corrected MLE) | 1.812 |
| Theta hat (MLE) | 0.667 | Theta star (bias corrected MLE) | 0.917 |
| nu hat (MLE) | 49.86 | nu star (bias corrected) | 36.23 |
| Mean (detects) | 1.662 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 1.387 |
| Maximum | 3.7 | Median | 1.2 |
| SD | 1.164 | CV | 0.84 |
| k hat (MLE) | 0.71 | k star (bias corrected MLE) | 0.588 |
| Theta hat (MLE) | 1.952 | Theta star (bias corrected MLE) | 2.357 |
| nu hat (MLE) | 17.04 | nu star (bias corrected) | 14.12 |
| Adjusted Level of Significance (β) | 0.029 | | |
| Approximate Chi Square Value (14.12, α) | 6.651 | Adjusted Chi Square Value (14.12, β) | 5.887 |
| 95% Gamma Approximate UCL (use when n>=50) | 2.943 | 95% Gamma Adjusted UCL (use when n<50) | 3.325 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 1.401 | SD (KM) | 1.097 |
| Variance (KM) | 1.203 | SE of Mean (KM) | 0.334 |
| k hat (KM) | 1.632 | k star (KM) | 1.28 |
| nu hat (KM) | 39.18 | nu star (KM) | 30.72 |
| theta hat (KM) | 0.858 | theta star (KM) | 1.095 |
| 80% gamma percentile (KM) | 2.205 | 90% gamma percentile (KM) | 3.036 |
| 95% gamma percentile (KM) | 3.852 | 99% gamma percentile (KM) | 5.714 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (30.72, α) | 19.06 | Adjusted Chi Square Value (30.72, β) | 17.67 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 2.259 | 95% Gamma Adjusted KM-UCL (use when n<50) | 2.436 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.965 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.139 | **Lilliefors GOF Test** |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.262 | Detected Data appear Lognormal at 5% Significance Level | |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1.425 | Mean in Log Scale | 0.008 |
| SD in Original Scale | 1.117 | SD in Log Scale | 0.938 |
| 95% t UCL (assumes normality of ROS data) | 2.004 | 95% Percentile Bootstrap UCL | 1.947 |
| 95% BCA Bootstrap UCL | 1.99 | 95% Bootstrap t UCL | 2.097 |
| 95% H-UCL (Log ROS) | 3.461 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.142 | KM Geo Mean | 0.868 |
| KM SD (logged) | 1.161 | 95% Critical H Value (KM-Log) | 3.216 |
| KM Standard Error of Mean (logged) | 0.353 | 95% H-UCL (KM -Log) | 5.249 |
| KM SD (logged) | 1.161 | 95% Critical H Value (KM-Log) | 3.216 |
| KM Standard Error of Mean (logged) | 0.353 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 1.398 | Mean in Log Scale | -0.194 |
| SD in Original Scale | 1.15 | SD in Log Scale | 1.327 |
| 95% t UCL (Assumes normality) | 1.994 | 95% H-Stat UCL | 8.183 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 2.001

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

| | | | |
|---|---|---|---|
| | | Approximate Chi Square Value (0.05) | 31.14 |
| Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 29.32 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 4.869 | 95% Adjusted Gamma UCL (use when n<50) | 5.171 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.981 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.128 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.139 | Mean of logged Data | 0.984 |
| Maximum of Logged Data | 2.241 | SD of logged Data | 0.692 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 5.607 | 90% Chebyshev (MVUE) UCL | 5.389 |
| 95% Chebyshev (MVUE) UCL | 6.327 | 97.5% Chebyshev (MVUE) UCL | 7.628 |
| 99% Chebyshev (MVUE) UCL | 10.18 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 4.457 | 95% Jackknife UCL | 4.562 |
| 95% Standard Bootstrap UCL | 4.382 | 95% Bootstrap-t UCL | 5.206 |
| 95% Hall's Bootstrap UCL | 8.793 | 95% Percentile Bootstrap UCL | 4.483 |
| 95% BCA Bootstrap UCL | 4.762 | | |
| 90% Chebyshev(Mean, Sd) UCL | 5.393 | 95% Chebyshev(Mean, Sd) UCL | 6.33 |
| 97.5% Chebyshev(Mean, Sd) UCL | 7.632 | 99% Chebyshev(Mean, Sd) UCL | 10.19 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 4.562 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

beta-BHC

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 26 |
| Number of Detects | 2 | Number of Non-Detects | 10 |
| Number of Distinct Detects | 2 | Number of Distinct Non-Detects | 7 |
| Minimum Detect | 0.17 | Minimum Non-Detect | 0.092 |
| Maximum Detect | 0.41 | Maximum Non-Detect | 0.47 |
| Variance Detects | 0.0288 | Percent Non-Detects | 83.33% |
| Mean Detects | 0.29 | SD Detects | 0.17 |
| Median Detects | 0.29 | CV Detects | 0.585 |
| Skewness Detects | N/A | Kurtosis Detects | N/A |
| Mean of Logged Detects | -1.332 | SD of Logged Detects | 0.623 |

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

### Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.13 | KM Standard Error of Mean | 0.0396 |
| KM SD | 0.092 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 0.201 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 0.195 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 0.248 | 95% KM Chebyshev UCL | 0.302 |
| 97.5% KM Chebyshev UCL | 0.377 | 99% KM Chebyshev UCL | 0.523 |

### Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.486 | k star (bias corrected MLE) | N/A |
| Theta hat (MLE) | 0.0529 | Theta star (bias corrected MLE) | N/A |
| nu hat (MLE) | 21.94 | nu star (bias corrected) | N/A |
| Mean (detects) | 0.29 | | |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.13 | SD (KM) | 0.092 |
| Variance (KM) | 0.00846 | SE of Mean (KM) | 0.0396 |
| k hat (KM) | 1.991 | k star (KM) | 1.549 |
| nu hat (KM) | 47.79 | nu star (KM) | 37.18 |
| theta hat (KM) | 0.0652 | theta star (KM) | 0.0838 |
| 80% gamma percentile (KM) | 0.2 | 90% gamma percentile (KM) | 0.268 |
| 95% gamma percentile (KM) | 0.334 | 99% gamma percentile (KM) | 0.483 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| | | Adjusted Level of Significance (β) | 0.029 |
| Approximate Chi Square Value (37.18, α) | 24.22 | Adjusted Chi Square Value (37.18, β) | 22.63 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.199 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.213 |

### Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.0759 | Mean in Log Scale | -3.139 |
| SD in Original Scale | 0.113 | SD in Log Scale | 0.966 |
| 95% t UCL (assumes normality of ROS data) | 0.135 | 95% Percentile Bootstrap UCL | 0.134 |
| 95% BCA Bootstrap UCL | 0.168 | 95% Bootstrap t UCL | 0.45 |
| 95% H-UCL (Log ROS) | 0.159 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.18 | KM Geo Mean | 0.113 |
| KM SD (logged) | 0.451 | 95% Critical H Value (KM-Log) | 2.083 |
| KM Standard Error of Mean (logged) | 0.197 | 95% H-UCL (KM -Log) | 0.166 |
| KM SD (logged) | 0.451 | 95% Critical H Value (KM-Log) | 2.083 |
| KM Standard Error of Mean (logged) | 0.197 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.118 | Mean in Log Scale | -2.402 |
| SD in Original Scale | 0.108 | SD in Log Scale | 0.704 |
| 95% t UCL (Assumes normality) | 0.175 | 95% H-Stat UCL | 0.194 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Data do not follow a Discernible Distribution at 5% Significance Level

**Suggested UCL to Use**

| | |
|---|---|
| 95% KM (Chebyshev) UCL | 0.302 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

4,4'-DDT

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 26 |
| Number of Detects | 8 | Number of Non-Detects | 4 |
| Number of Distinct Detects | 7 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 0.12 | Minimum Non-Detect | 0.06 |
| Maximum Detect | 4 | Maximum Non-Detect | 0.21 |
| Variance Detects | 1.923 | Percent Non-Detects | 33.33% |
| Mean Detects | 1.06 | SD Detects | 1.387 |
| Median Detects | 0.43 | CV Detects | 1.308 |
| Skewness Detects | 1.757 | Kurtosis Detects | 2.462 |
| Mean of Logged Detects | -0.659 | SD of Logged Detects | 1.277 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.733 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.313 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.729 | KM Standard Error of Mean | 0.357 |
| KM SD | 1.158 | 95% KM (BCA) UCL | 1.322 |
| 95% KM (t) UCL | 1.371 | 95% KM (Percentile Bootstrap) UCL | 1.333 |
| 95% KM (z) UCL | 1.317 | 95% KM Bootstrap t UCL | 3.272 |
| 90% KM Chebyshev UCL | 1.801 | 95% KM Chebyshev UCL | 2.287 |
| 97.5% KM Chebyshev UCL | 2.961 | 99% KM Chebyshev UCL | 4.285 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.477 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.742 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.252 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.303 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.824 | k star (bias corrected MLE) | 0.598 |
| Theta hat (MLE) | 1.286 | Theta star (bias corrected MLE) | 1.771 |
| nu hat (MLE) | 13.18 | nu star (bias corrected) | 9.574 |
| Mean (detects) | 1.06 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.71 |
| Maximum | 4 | Median | 0.18 |
| SD | 1.221 | CV | 1.72 |
| k hat (MLE) | 0.403 | k star (bias corrected MLE) | 0.358 |
| Theta hat (MLE) | 1.763 | Theta star (bias corrected MLE) | 1.985 |
| nu hat (MLE) | 9.666 | nu star (bias corrected) | 8.583 |
| Adjusted Level of Significance (β) | 0.029 | | |
| Approximate Chi Square Value (8.58, α) | 3.077 | Adjusted Chi Square Value (8.58, β) | 2.596 |
| 95% Gamma Approximate UCL (use when n>=50) | 1.98 | 95% Gamma Adjusted UCL (use when n<50) | 2.348 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.729 | SD (KM) | 1.158 |
| Variance (KM) | 1.341 | SE of Mean (KM) | 0.357 |
| k hat (KM) | 0.396 | k star (KM) | 0.353 |
| nu hat (KM) | 9.505 | nu star (KM) | 8.462 |
| theta hat (KM) | 1.84 | theta star (KM) | 2.067 |
| 80% gamma percentile (KM) | 1.155 | 90% gamma percentile (KM) | 2.102 |
| 95% gamma percentile (KM) | 3.161 | 99% gamma percentile (KM) | 5.862 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (8.46, α) | 3.006 | Adjusted Chi Square Value (8.46, β) | 2.531 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 2.052 | 95% Gamma Adjusted KM-UCL (use when n<50) | 2.437 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.93 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.183 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.716 | Mean in Log Scale | -1.645 |
| SD in Original Scale | 1.217 | SD in Log Scale | 1.788 |
| 95% t UCL (assumes normality of ROS data) | 1.347 | 95% Percentile Bootstrap UCL | 1.319 |
| 95% BCA Bootstrap UCL | 1.507 | 95% Bootstrap t UCL | 3.212 |
| 95% H-UCL (Log ROS) | 10.82 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -1.353 | KM Geo Mean | 0.259 |
| KM SD (logged) | 1.389 | 95% Critical H Value (KM-Log) | 3.667 |
| KM Standard Error of Mean (logged) | 0.43 | 95% H-UCL (KM -Log) | 3.151 |
| KM SD (logged) | 1.389 | 95% Critical H Value (KM-Log) | 3.667 |
| KM Standard Error of Mean (logged) | 0.43 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.725 | Mean in Log Scale | -1.46 |
| SD in Original Scale | 1.212 | SD in Log Scale | 1.591 |
| 95% t UCL (Assumes normality) | 1.353 | 95% H-Stat UCL | 5.838 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

**Nonparametric Distribution Free UCL Statistics**

**Detected Data appear Gamma Distributed at 5% Significance Level**

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM Bootstrap t UCL | 3.272 | a Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) | 2.437 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

DIELDRIN

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 26 |
| Minimum | 0.32 | Mean | 1.125 |
| Maximum | 2.6 | Median | 0.98 |
| SD | 0.739 | Std. Error of Mean | 0.213 |
| Coefficient of Variation | 0.657 | Skewness | 1.094 |

| Normal GOF Test | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.877 | Shapiro Wilk GOF Test | |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.209 | Lilliefors GOF Test | |
| 5% Lilliefors Critical Value | 0.243 | Data appear Normal at 5% Significance Level | |
| Data appear Normal at 5% Significance Level | | | |

| Assuming Normal Distribution | | | |
|---|---|---|---|
| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 95% Student's-t UCL | 1.508 | 95% Adjusted-CLT UCL (Chen-1995) | 1.548 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.519 |

| Gamma GOF Test | | | |
|---|---|---|---|
| A-D Test Statistic | 0.243 | Anderson-Darling Gamma GOF Test | |
| 5% A-D Critical Value | 0.74 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.128 | Kolmogorov-Smirnov Gamma GOF Test | |
| 5% K-S Critical Value | 0.248 | Detected data appear Gamma Distributed at 5% Significance Level | |
| Detected data appear Gamma Distributed at 5% Significance Level | | | |

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 2.69 | k star (bias corrected MLE) | 2.073 |
| Theta hat (MLE) | 0.418 | Theta star (bias corrected MLE) | 0.542 |
| nu hat (MLE) | 64.57 | nu star (bias corrected) | 49.76 |
| MLE Mean (bias corrected) | 1.125 | MLE Sd (bias corrected) | 0.781 |
| | | Approximate Chi Square Value (0.05) | 34.56 |
| Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 32.64 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.619 | 95% Adjusted Gamma UCL (use when n<50) | 1.714 |

| Lognormal GOF Test | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.96 | Shapiro Wilk Lognormal GOF Test | |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.107 | Lilliefors Lognormal GOF Test | |
| 5% Lilliefors Critical Value | 0.243 | Data appear Lognormal at 5% Significance Level | |
| Data appear Lognormal at 5% Significance Level | | | |

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.139 | Mean of logged Data | -0.0798 |
| Maximum of Logged Data | 0.956 | SD of logged Data | 0.669 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 1.862 | 90% Chebyshev (MVUE) UCL | 1.81 |
| 95% Chebyshev (MVUE) UCL | 2.118 | 97.5% Chebyshev (MVUE) UCL | 2.545 |
| 99% Chebyshev (MVUE) UCL | 3.385 | | |

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 1.476 | 95% Jackknife UCL | 1.508 |
| 95% Standard Bootstrap UCL | 1.455 | 95% Bootstrap-t UCL | 1.676 |
| 95% Hall's Bootstrap UCL | 1.908 | 95% Percentile Bootstrap UCL | 1.475 |
| 95% BCA Bootstrap UCL | 1.538 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.765 | 95% Chebyshev(Mean, Sd) UCL | 2.055 |
| 97.5% Chebyshev(Mean, Sd) UCL | 2.457 | 99% Chebyshev(Mean, Sd) UCL | 3.248 |

| Suggested UCL to Use | |
|---|---|
| 95% Student's-t UCL | 1.508 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

ENDRIN

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 26 |
| Number of Detects | 9 | Number of Non-Detects | 3 |
| Number of Distinct Detects | 9 | Number of Distinct Non-Detects | 3 |
| Minimum Detect | 0.23 | Minimum Non-Detect | 0.28 |
| Maximum Detect | 2.4 | Maximum Non-Detect | 0.61 |
| Variance Detects | 0.595 | Percent Non-Detects | 25% |
| Mean Detects | 1.041 | SD Detects | 0.771 |
| Median Detects | 0.79 | CV Detects | 0.741 |
| Skewness Detects | 0.882 | Kurtosis Detects | -0.378 |
| Mean of Logged Detects | -0.233 | SD of Logged Detects | 0.821 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.893 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.829 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.183 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.274 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.849 | KM Standard Error of Mean | 0.219 |
| KM SD | 0.714 | 95% KM (BCA) UCL | 1.229 |
| 95% KM (t) UCL | 1.242 | 95% KM (Percentile Bootstrap) UCL | 1.216 |
| 95% KM (z) UCL | 1.209 | 95% KM Bootstrap t UCL | 1.453 |
| 90% KM Chebyshev UCL | 1.506 | 95% KM Chebyshev UCL | 1.803 |
| 97.5% KM Chebyshev UCL | 2.216 | 99% KM Chebyshev UCL | 3.027 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.224 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.73 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.132 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.283 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.981 | k star (bias corrected MLE) | 1.395 |
| Theta hat (MLE) | 0.526 | Theta star (bias corrected MLE) | 0.747 |
| nu hat (MLE) | 35.65 | nu star (bias corrected) | 25.1 |
| Mean (detects) | 1.041 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.115 | Mean | 0.817 |
| Maximum | 2.4 | Median | 0.59 |
| SD | 0.773 | CV | 0.947 |
| k hat (MLE) | 1.213 | k star (bias corrected MLE) | 0.965 |
| Theta hat (MLE) | 0.673 | Theta star (bias corrected MLE) | 0.846 |
| nu hat (MLE) | 29.12 | nu star (bias corrected) | 23.17 |
| Adjusted Level of Significance (β) | 0.029 | | |
| Approximate Chi Square Value (23.17, α) | 13.22 | Adjusted Chi Square Value (23.17, β) | 12.09 |
| 95% Gamma Approximate UCL (use when n>=50) | 1.432 | 95% Gamma Adjusted UCL (use when n<50) | 1.566 |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.849 | SD (KM) | 0.714 |
| Variance (KM) | 0.51 | SE of Mean (KM) | 0.219 |
| k hat (KM) | 1.413 | k star (KM) | 1.116 |
| nu hat (KM) | 33.92 | nu star (KM) | 26.77 |
| theta hat (KM) | 0.6 | theta star (KM) | 0.761 |
| 80% gamma percentile (KM) | 1.353 | 90% gamma percentile (KM) | 1.902 |
| 95% gamma percentile (KM) | 2.447 | 99% gamma percentile (KM) | 3.701 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (26.77, α) | 15.98 | Adjusted Chi Square Value (26.77, β) | 14.72 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.422 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1.544 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.951 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.829 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.127 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.274 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.849 | Mean in Log Scale | -0.5 |
| SD in Original Scale | 0.744 | SD in Log Scale | 0.852 |
| 95% t UCL (assumes normality of ROS data) | 1.235 | 95% Percentile Bootstrap UCL | 1.2 |
| 95% BCA Bootstrap UCL | 1.258 | 95% Bootstrap t UCL | 1.474 |
| 95% H-UCL (Log ROS) | 1.725 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.508 | KM Geo Mean | 0.602 |
| KM SD (logged) | 0.83 | 95% Critical H Value (KM-Log) | 2.62 |
| KM Standard Error of Mean (logged) | 0.257 | 95% H-UCL (KM -Log) | 1.636 |
| KM SD (logged) | 0.83 | 95% Critical H Value (KM-Log) | 2.62 |
| KM Standard Error of Mean (logged) | 0.257 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.839 | Mean in Log Scale | -0.553 |
| SD in Original Scale | 0.754 | SD in Log Scale | 0.925 |
| 95% t UCL (Assumes normality) | 1.23 | 95% H-Stat UCL | 1.917 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

### Suggested UCL to Use

95% KM (t) UCL 1.242

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

gamma-BHC (Lindane)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 26 |
| Number of Detects | 3 | Number of Non-Detects | 9 |
| Number of Distinct Detects | 3 | Number of Distinct Non-Detects | 8 |
| Minimum Detect | 0.21 | Minimum Non-Detect | 0.071 |
| Maximum Detect | 0.9 | Maximum Non-Detect | 0.43 |
| Variance Detects | 0.121 | Percent Non-Detects | 75% |
| Mean Detects | 0.583 | SD Detects | 0.348 |
| Median Detects | 0.64 | CV Detects | 0.597 |
| Skewness Detects | -0.712 | Kurtosis Detects | N/A |
| Mean of Logged Detects | -0.704 | SD of Logged Detects | 0.761 |

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.98 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.231 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 0.2 | KM Standard Error of Mean | 0.0932 |
| KM SD | 0.263 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 0.368 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 0.354 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 0.48 | 95% KM Chebyshev UCL | 0.607 |
| 97.5% KM Chebyshev UCL | 0.782 | 99% KM Chebyshev UCL | 1.128 |

**Gamma GOF Tests on Detected Observations Only**

Not Enough Data to Perform GOF Test

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.185 | k star (bias corrected MLE) | N/A |
| Theta hat (MLE) | 0.183 | Theta star (bias corrected MLE) | N/A |
| nu hat (MLE) | 19.11 | nu star (bias corrected) | N/A |
| Mean (detects) | 0.583 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 0.153 |
| Maximum | 0.9 | Median | 0.01 |
| SD | 0.299 | CV | 1.949 |
| k hat (MLE) | 0.378 | k star (bias corrected MLE) | 0.339 |
| Theta hat (MLE) | 0.405 | Theta star (bias corrected MLE) | 0.452 |
| nu hat (MLE) | 9.081 | nu star (bias corrected) | 8.144 |
| Adjusted Level of Significance (β) | 0.029 | | |
| Approximate Chi Square Value (8.14, α) | 2.819 | Adjusted Chi Square Value (8.14, β) | 2.363 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.443 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 0.2 | SD (KM) | 0.263 |
| Variance (KM) | 0.0693 | SE of Mean (KM) | 0.0932 |
| k hat (KM) | 0.579 | k star (KM) | 0.49 |
| nu hat (KM) | 13.9 | nu star (KM) | 11.76 |
| theta hat (KM) | 0.346 | theta star (KM) | 0.409 |
| 80% gamma percentile (KM) | 0.329 | 90% gamma percentile (KM) | 0.544 |
| 95% gamma percentile (KM) | 0.775 | 99% gamma percentile (KM) | 1.344 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (11.76, α) | 5.07 | Adjusted Chi Square Value (11.76, β) | 4.418 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.465 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.533 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.914 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.299 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.169 | Mean in Log Scale | -2.814 |
| SD in Original Scale | 0.291 | SD in Log Scale | 1.341 |
| 95% t UCL (assumes normality of ROS data) | 0.32 | 95% Percentile Bootstrap UCL | 0.309 |
| 95% BCA Bootstrap UCL | 0.345 | 95% Bootstrap t UCL | 0.852 |
| 95% H-UCL (Log ROS) | 0.623 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | -2.15 | KM Geo Mean | 0.117 |
| KM SD (logged) | 0.897 | 95% Critical H Value (KM-Log) | 2.732 |
| KM Standard Error of Mean (logged) | 0.319 | 95% H-UCL (KM -Log) | 0.365 |
| KM SD (logged) | 0.897 | 95% Critical H Value (KM-Log) | 2.732 |
| KM Standard Error of Mean (logged) | 0.319 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.198 | Mean in Log Scale | -2.33 |
| SD in Original Scale | 0.28 | SD in Log Scale | 1.159 |
| 95% t UCL (Assumes normality) | 0.343 | 95% H-Stat UCL | 0.585 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 0.368

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

HEPTACHLOR EPOXIDE

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 12 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 26 |
| Minimum | 0.14 | Mean | 1.219 |
| Maximum | 4.8 | Median | 0.905 |
| SD | 1.273 | Std. Error of Mean | 0.367 |
| Coefficient of Variation | 1.045 | Skewness | 2.346 |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.718 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.859 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.339 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.243 | Data Not Normal at 5% Significance Level | |
| Data Not Normal at 5% Significance Level | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.879 | 95% Adjusted-CLT UCL (Chen-1995) | 2.089 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.92 |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.468 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.749 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.225 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.25 | Detected data appear Gamma Distributed at 5% Significance Level | |
| Detected data appear Gamma Distributed at 5% Significance Level | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 1.335 | k star (bias corrected MLE) | 1.057 |
| Theta hat (MLE) | 0.913 | Theta star (bias corrected MLE) | 1.153 |
| nu hat (MLE) | 32.03 | nu star (bias corrected) | 25.36 |
| MLE Mean (bias corrected) | 1.219 | MLE Sd (bias corrected) | 1.186 |
| | | Approximate Chi Square Value (0.05) | 14.89 |
| Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 13.67 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 2.076 | 95% Adjusted Gamma UCL (use when n<50) | 2.26 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.929 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.179 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.243 | Data appear Lognormal at 5% Significance Level | |
| Data appear Lognormal at 5% Significance Level | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | -1.966 | Mean of logged Data | -0.221 |
| Maximum of Logged Data | 1.569 | SD of logged Data | 1 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 3.18 | 90% Chebyshev (MVUE) UCL | 2.404 |
| 95% Chebyshev (MVUE) UCL | 2.927 | 97.5% Chebyshev (MVUE) UCL | 3.654 |
| 99% Chebyshev (MVUE) UCL | 5.081 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| Data appear to follow a Discernible Distribution at 5% Significance Level | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 1.823 | 95% Jackknife UCL | 1.879 |
| 95% Standard Bootstrap UCL | 1.785 | 95% Bootstrap-t UCL | 2.961 |
| 95% Hall's Bootstrap UCL | 5.177 | 95% Percentile Bootstrap UCL | 1.878 |
| 95% BCA Bootstrap UCL | 1.994 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2.321 | 95% Chebyshev(Mean, Sd) UCL | 2.821 |
| 97.5% Chebyshev(Mean, Sd) UCL | 3.514 | 99% Chebyshev(Mean, Sd) UCL | 4.875 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Adjusted Gamma UCL | 2.26 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Total HMW PAHs

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 5 |
| | | Number of Missing Observations | 28 |
| Number of Detects | 4 | Number of Non-Detects | 6 |
| Number of Distinct Detects | 4 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 37.1 | Minimum Non-Detect | 11 |
| Maximum Detect | 270 | Maximum Non-Detect | 11 |
| Variance Detects | 11156 | Percent Non-Detects | 60% |
| Mean Detects | 120.5 | SD Detects | 105.6 |
| Median Detects | 87.5 | CV Detects | 0.876 |
| Skewness Detects | 1.409 | Kurtosis Detects | 1.631 |
| Mean of Logged Detects | 4.504 | SD of Logged Detects | 0.875 |

**Normal GOF Test on Detects Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.87 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.256 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.375 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 54.81 | KM Standard Error of Mean | 28.81 |
| KM SD | 78.9 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 107.6 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 102.2 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 141.2 | 95% KM Chebyshev UCL | 180.4 |
| 97.5% KM Chebyshev UCL | 234.7 | 99% KM Chebyshev UCL | 341.5 |

**Gamma GOF Tests on Detected Observations Only**

| | | |
|---|---|---|
| A-D Test Statistic | 0.283 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.661 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.251 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.398 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.887 | k star (bias corrected MLE) | 0.639 |
| Theta hat (MLE) | 63.86 | Theta star (bias corrected MLE) | 188.8 |
| nu hat (MLE) | 15.1 | nu star (bias corrected) | 5.108 |
| Mean (detects) | 120.5 | | |

**Gamma ROS Statistics using Imputed Non-Detects**

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 48.22 |
| Maximum | 270 | Median | 0.01 |
| SD | 87.13 | CV | 1.807 |
| k hat (MLE) | 0.158 | k star (bias corrected MLE) | 0.177 |
| Theta hat (MLE) | 305.7 | Theta star (bias corrected MLE) | 272.3 |
| nu hat (MLE) | 3.155 | nu star (bias corrected) | 3.542 |
| Adjusted Level of Significance (β) | 0.0267 | | |
| Approximate Chi Square Value (3.54, α) | 0.549 | Adjusted Chi Square Value (3.54, β) | 0.385 |
| 95% Gamma Approximate UCL (use when n>=50) | 310.8 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

**Estimates of Gamma Parameters using KM Estimates**

| | | | |
|---|---|---|---|
| Mean (KM) | 54.81 | SD (KM) | 78.9 |
| Variance (KM) | 6226 | SE of Mean (KM) | 28.81 |
| k hat (KM) | 0.483 | k star (KM) | 0.404 |
| nu hat (KM) | 9.651 | nu star (KM) | 8.089 |
| theta hat (KM) | 113.6 | theta star (KM) | 135.5 |
| 80% gamma percentile (KM) | 88.57 | 90% gamma percentile (KM) | 154.5 |
| 95% gamma percentile (KM) | 226.9 | 99% gamma percentile (KM) | 408.6 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (8.09, α) | 2.787 | Adjusted Chi Square Value (8.09, β) | 2.275 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 159.1 | 95% Gamma Adjusted KM-UCL (use when n<50) | 194.9 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.968 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.208 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.375 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 51.61 | Mean in Log Scale | 2.583 |
| SD in Original Scale | 85.15 | SD in Log Scale | 1.918 |
| 95% t UCL (assumes normality of ROS data) | 101 | 95% Percentile Bootstrap UCL | 98.85 |
| 95% BCA Bootstrap UCL | 120.2 | 95% Bootstrap t UCL | 227.7 |
| 95% H-UCL (Log ROS) | 2316 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | 3.24 | KM Geo Mean | 25.54 |
| KM SD (logged) | 1.138 | 95% Critical H Value (KM-Log) | 3.392 |
| KM Standard Error of Mean (logged) | 0.415 | 95% H-UCL (KM -Log) | 176.6 |
| KM SD (logged) | 1.138 | 95% Critical H Value (KM-Log) | 3.392 |
| KM Standard Error of Mean (logged) | 0.415 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 51.51 | Mean in Log Scale | 2.825 |
| SD in Original Scale | 85.13 | SD in Log Scale | 1.531 |
| 95% t UCL (Assumes normality) | 100.9 | 95% H-Stat UCL | 483.6 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 107.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

## Total LMW PAHs

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 4 |
| | | Number of Missing Observations | 28 |
| Number of Detects | 3 | Number of Non-Detects | 7 |
| Number of Distinct Detects | 3 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 8.5 | Minimum Non-Detect | 8.4 |
| Maximum Detect | 23.1 | Maximum Non-Detect | 8.5 |
| Variance Detects | 67.81 | Percent Non-Detects | 70% |
| Mean Detects | 13.6 | SD Detects | 8.235 |
| Median Detects | 9.2 | CV Detects | 0.605 |
| Skewness Detects | 1.718 | Kurtosis Detects | N/A |
| Mean of Logged Detects | 2.5 | SD of Logged Detects | 0.556 |

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.786 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.37 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 9.96 | KM Standard Error of Mean | 1.699 |
| KM SD | 4.386 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 13.07 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 12.75 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 15.06 | 95% KM Chebyshev UCL | 17.37 |
| 97.5% KM Chebyshev UCL | 20.57 | 99% KM Chebyshev UCL | 26.86 |

### Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.691 | k star (bias corrected MLE) | N/A |
| Theta hat (MLE) | 2.899 | Theta star (bias corrected MLE) | N/A |
| nu hat (MLE) | 28.14 | nu star (bias corrected) | N/A |
| Mean (detects) | 13.6 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 4.087 |
| Maximum | 23.1 | Median | 0.01 |
| SD | 7.626 | CV | 1.866 |
| k hat (MLE) | 0.191 | k star (bias corrected MLE) | 0.2 |
| Theta hat (MLE) | 21.4 | Theta star (bias corrected MLE) | 20.4 |
| nu hat (MLE) | 3.819 | nu star (bias corrected) | 4.007 |
| Adjusted Level of Significance (β) | 0.0267 | | |
| Approximate Chi Square Value (4.01, α) | 0.724 | Adjusted Chi Square Value (4.01, β) | 0.521 |
| 95% Gamma Approximate UCL (use when n>=50) | 22.61 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 9.96 | SD (KM) | 4.386 |
| Variance (KM) | 19.24 | SE of Mean (KM) | 1.699 |
| k hat (KM) | 5.156 | k star (KM) | 3.676 |
| nu hat (KM) | 103.1 | nu star (KM) | 73.52 |
| theta hat (KM) | 1.932 | theta star (KM) | 2.71 |
| 80% gamma percentile (KM) | 13.87 | 90% gamma percentile (KM) | 16.93 |
| 95% gamma percentile (KM) | 19.75 | 99% gamma percentile (KM) | 25.81 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (73.52, α) | 54.77 | Adjusted Chi Square Value (73.52, β) | 51.97 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 13.37 | 95% Gamma Adjusted KM-UCL (use when n<50) | 14.09 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.809 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.36 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 5.167 | Mean in Log Scale | 0.894 |
| SD in Original Scale | 7.051 | SD in Log Scale | 1.305 |
| 95% t UCL (assumes normality of ROS data) | 9.254 | 95% Percentile Bootstrap UCL | 9.055 |
| 95% BCA Bootstrap UCL | 10.52 | 95% Bootstrap t UCL | 13.94 |
| 95% H-UCL (Log ROS) | 29.42 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | 2.24 | KM Geo Mean | 9.39 |
| KM SD (logged) | 0.301 | 95% Critical H Value (KM-Log) | 1.978 |
| KM Standard Error of Mean (logged) | 0.117 | 95% H-UCL (KM -Log) | 11.99 |
| KM SD (logged) | 0.301 | 95% Critical H Value (KM-Log) | 1.978 |
| KM Standard Error of Mean (logged) | 0.117 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 7.025 | Mean in Log Scale | 1.756 |
| SD in Original Scale | 5.971 | SD in Log Scale | 0.576 |
| 95% t UCL (Assumes normality) | 10.49 | 95% H-Stat UCL | 10.7 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

| | |
|---|---|
| 95% KM (t) UCL | 13.07 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

Total PAHs

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 5 |
| | | Number of Missing Observations | 28 |
| Number of Detects | 4 | Number of Non-Detects | 6 |
| Number of Distinct Detects | 4 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 46.3 | Minimum Non-Detect | 11 |
| Maximum Detect | 293.1 | Maximum Non-Detect | 11 |
| Variance Detects | 13029 | Percent Non-Detects | 60% |
| Mean Detects | 130.7 | SD Detects | 114.1 |
| Median Detects | 91.75 | CV Detects | 0.873 |
| Skewness Detects | 1.462 | Kurtosis Detects | 1.759 |
| Mean of Logged Detects | 4.597 | SD of Logged Detects | 0.845 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.844 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.261 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.375 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 58.89 | KM Standard Error of Mean | 31.3 |
| KM SD | 85.73 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 116.3 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 110.4 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 152.8 | 95% KM Chebyshev UCL | 195.3 |
| 97.5% KM Chebyshev UCL | 254.4 | 99% KM Chebyshev UCL | 370.3 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.355 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.661 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.285 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.398 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.963 | k star (bias corrected MLE) | 0.657 |
| Theta hat (MLE) | 66.59 | Theta star (bias corrected MLE) | 198.8 |
| nu hat (MLE) | 15.7 | nu star (bias corrected) | 5.26 |
| Mean (detects) | 130.7 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 52.3 |
| Maximum | 293.1 | Median | 0.01 |
| SD | 94.34 | CV | 1.804 |
| k hat (MLE) | 0.156 | k star (bias corrected MLE) | 0.176 |
| Theta hat (MLE) | 334.2 | Theta star (bias corrected MLE) | 296.8 |
| nu hat (MLE) | 3.13 | nu star (bias corrected) | 3.524 |
| Adjusted Level of Significance (β) | 0.0267 | | |
| Approximate Chi Square Value (3.52, α) | 0.543 | Adjusted Chi Square Value (3.52, β) | 0.381 |
| 95% Gamma Approximate UCL (use when n>=50) | 339.2 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 58.89 | SD (KM) | 85.73 |
| Variance (KM) | 7349 | SE of Mean (KM) | 31.3 |
| k hat (KM) | 0.472 | k star (KM) | 0.397 |
| nu hat (KM) | 9.438 | nu star (KM) | 7.94 |
| theta hat (KM) | 124.8 | theta star (KM) | 148.3 |
| 80% gamma percentile (KM) | 94.96 | 90% gamma percentile (KM) | 166.6 |
| 95% gamma percentile (KM) | 245.3 | 99% gamma percentile (KM) | 443.5 |

**Gamma Kaplan-Meier (KM) Statistics**

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (7.94, α) | 2.7 | Adjusted Chi Square Value (7.94, β) | 2.199 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 173.2 | 95% Gamma Adjusted KM-UCL (use when n<50) | 212.6 |

**Lognormal GOF Test on Detected Observations Only**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.922 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.251 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.375 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

**Lognormal ROS Statistics Using Imputed Non-Detects**

| | | | |
|---|---|---|---|
| Mean in Original Scale | 56.43 | Mean in Log Scale | 2.759 |
| SD in Original Scale | 91.93 | SD in Log Scale | 1.837 |
| 95% t UCL (assumes normality of ROS data) | 109.7 | 95% Percentile Bootstrap UCL | 106 |
| 95% BCA Bootstrap UCL | 127.2 | 95% Bootstrap t UCL | 246.1 |
| 95% H-UCL (Log ROS) | 1828 | | |

**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| KM Mean (logged) | 3.278 | KM Geo Mean | 26.51 |
| KM SD (logged) | 1.173 | 95% Critical H Value (KM-Log) | 3.468 |
| KM Standard Error of Mean (logged) | 0.428 | 95% H-UCL (KM -Log) | 204.6 |
| KM SD (logged) | 1.173 | 95% Critical H Value (KM-Log) | 3.468 |
| KM Standard Error of Mean (logged) | 0.428 | | |

**DL/2 Statistics**

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 55.59 | Mean in Log Scale | 2.862 |
| SD in Original Scale | 92.33 | SD in Log Scale | 1.571 |
| 95% t UCL (Assumes normality) | 109.1 | 95% H-Stat UCL | 594.1 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

**Nonparametric Distribution Free UCL Statistics**

Detected Data appear Normal Distributed at 5% Significance Level

**Suggested UCL to Use**

95% KM (t) UCL 116.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TCDD-TEQ (Bird)

| General Statistics | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 20 |
| Minimum | 0.875 | Mean | 1.32 |
| Maximum | 1.854 | Median | 1.33 |
| SD | 0.322 | Std. Error of Mean | 0.0931 |
| Coefficient of Variation | 0.244 | Skewness | 0.243 |

| Normal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.949 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.152 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

| Assuming Normal Distribution | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 1.487 | 95% Adjusted-CLT UCL (Chen-1995) | 1.48 |
| | | 95% Modified-t UCL (Johnson-1978) | 1.488 |

| Gamma GOF Test | | |
|---|---|---|
| A-D Test Statistic | 0.263 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.732 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.146 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.245 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

| Gamma Statistics | | | |
|---|---|---|---|
| k hat (MLE) | 18.15 | k star (bias corrected MLE) | 13.67 |
| Theta hat (MLE) | 0.0727 | Theta star (bias corrected MLE) | 0.0966 |
| nu hat (MLE) | 435.6 | nu star (bias corrected) | 328.1 |
| MLE Mean (bias corrected) | 1.32 | MLE Sd (bias corrected) | 0.357 |
| | | Approximate Chi Square Value (0.05) | 287.1 |
| Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 281.2 |

| Assuming Gamma Distribution | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 1.509 | 95% Adjusted Gamma UCL (use when n<50) | 1.54 |

| Lognormal GOF Test | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.954 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.129 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

| Lognormal Statistics | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.133 | Mean of logged Data | 0.25 |
| Maximum of Logged Data | 0.617 | SD of logged Data | 0.248 |

| Assuming Lognormal Distribution | | | |
|---|---|---|---|
| 95% H-UCL | 1.524 | 90% Chebyshev (MVUE) UCL | 1.605 |
| 95% Chebyshev (MVUE) UCL | 1.735 | 97.5% Chebyshev (MVUE) UCL | 1.914 |
| 99% Chebyshev (MVUE) UCL | 2.266 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

| Nonparametric Distribution Free UCLs | | | |
|---|---|---|---|
| 95% CLT UCL | 1.473 | 95% Jackknife UCL | 1.487 |
| 95% Standard Bootstrap UCL | 1.468 | 95% Bootstrap-t UCL | 1.5 |
| 95% Hall's Bootstrap UCL | 1.471 | 95% Percentile Bootstrap UCL | 1.473 |
| 95% BCA Bootstrap UCL | 1.47 | | |
| 90% Chebyshev(Mean, Sd) UCL | 1.599 | 95% Chebyshev(Mean, Sd) UCL | 1.726 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.901 | 99% Chebyshev(Mean, Sd) UCL | 2.246 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 1.487 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benthic Invertebrate Tissue

TCDD-TEQ (Mammal)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 20 |
| Minimum | 0.263 | Mean | 0.698 |
| Maximum | 1.221 | Median | 0.713 |
| SD | 0.267 | Std. Error of Mean | 0.077 |
| Coefficient of Variation | 0.382 | Skewness | 0.146 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.969 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.142 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.836 | 95% Adjusted-CLT UCL (Chen-1995) | 0.828 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.837 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.368 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.732 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.168 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.246 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 6.443 | k star (bias corrected MLE) | 4.888 |
| Theta hat (MLE) | 0.108 | Theta star (bias corrected MLE) | 0.143 |
| nu hat (MLE) | 154.6 | nu star (bias corrected) | 117.3 |
| MLE Mean (bias corrected) | 0.698 | MLE Sd (bias corrected) | 0.316 |
| | | Approximate Chi Square Value (0.05) | 93.3 |
| Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 90.03 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.878 | 95% Adjusted Gamma UCL (use when n<50) | 0.909 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.916 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.192 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.335 | Mean of logged Data | -0.439 |
| Maximum of Logged Data | 0.2 | SD of logged Data | 0.442 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.936 | 90% Chebyshev (MVUE) UCL | 0.979 |
| 95% Chebyshev (MVUE) UCL | 1.103 | 97.5% Chebyshev (MVUE) UCL | 1.276 |
| 99% Chebyshev (MVUE) UCL | 1.615 | | |

**Nonparametric Distribution Free UCL Statistics**

Data appear to follow a Discernible Distribution at 5% Significance Level

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.825 | 95% Jackknife UCL | 0.836 |
| 95% Standard Bootstrap UCL | 0.818 | 95% Bootstrap-t UCL | 0.844 |
| 95% Hall's Bootstrap UCL | 0.848 | 95% Percentile Bootstrap UCL | 0.826 |
| 95% BCA Bootstrap UCL | 0.824 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.929 | 95% Chebyshev(Mean, Sd) UCL | 1.034 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1.179 | 99% Chebyshev(Mean, Sd) UCL | 1.464 |

**Suggested UCL to Use**

95% Student's-t UCL 0.836

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

| | Goodness-of-Fit Test Statistics |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.16/25/2019 12:27:44 PM |
| From File | 2SampleTests_FishInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 0.95 |

Lead (eu3)

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 6 |
| Number of Distinct Observations | 6 |
| Minimum | 0.23 |
| Maximum | 1.1 |
| Mean of Raw Data | 0.513 |
| Standard Deviation of Raw Data | 0.304 |
| Khat | 4.344 |
| Theta hat | 0.118 |
| Kstar | 2.283 |
| Theta star | 0.225 |
| Mean of Log Transformed Data | -0.786 |
| Standard Deviation of Log Transformed Data | 0.516 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.88 |
| Shapiro Wilk Test Statistic | 0.799 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.338 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Approximate Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.943 |
| A-D Test Statistic | 0.414 |
| A-D Critical (0.05) Value | 0.699 |
| K-S Test Statistic | 0.275 |
| K-S Critical(0.05) Value | 0.333 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.958 |
| Shapiro Wilk Test Statistic | 0.94 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.247 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Lognormal at (0.05) Significance Level

Lead (kl)

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 9 |
| Number of Distinct Observations | 8 |
| Minimum | 0.13 |
| Maximum | 1.5 |
| Mean of Raw Data | 0.874 |
| Standard Deviation of Raw Data | 0.425 |
| Khat | 3.173 |
| Theta hat | 0.276 |
| Kstar | 2.189 |
| Theta star | 0.399 |
| Mean of Log Transformed Data | -0.3 |
| Standard Deviation of Log Transformed Data | 0.721 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.947 |
| Shapiro Wilk Test Statistic | 0.903 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.235 |
| Lilliefors Test Statistic | 0.254 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.923 |
| A-D Test Statistic | 0.661 |
| A-D Critical (0.05) Value | 0.726 |
| K-S Test Statistic | 0.239 |
| K-S Critical(0.05) Value | 0.281 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.863 |
| Shapiro Wilk Test Statistic | 0.77 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.00603 |
| Lilliefors Test Statistic | 0.291 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data not Lognormal at (0.05) Significance Level

Nickel (eu3)

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 6 |
| Number of Distinct Observations | 5 |
| Minimum | 0.34 |
| Maximum | 0.79 |
| Mean of Raw Data | 0.59 |
| Standard Deviation of Raw Data | 0.198 |
| Khat | 9.726 |
| Theta hat | 0.0607 |
| Kstar | 4.974 |
| Theta star | 0.119 |
| Mean of Log Transformed Data | -0.58 |
| Standard Deviation of Log Transformed Data | 0.363 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.937 |
| Shapiro Wilk Test Statistic | 0.851 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.29 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.908 |
| A-D Test Statistic | 0.524 |
| A-D Critical (0.05) Value | 0.698 |
| K-S Test Statistic | 0.312 |
| K-S Critical(0.05) Value | 0.332 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.939 |
| Shapiro Wilk Test Statistic | 0.858 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.289 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Lognormal at (0.05) Significance Level

Nickel (kl)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 9 |
| Number of Distinct Observations | 8 |
| Minimum | 0.16 |
| Maximum | 1.2 |
| Mean of Raw Data | 0.743 |
| Standard Deviation of Raw Data | 0.356 |
| Khat | 3.564 |
| Theta hat | 0.209 |
| Kstar | 2.45 |
| Theta star | 0.303 |
| Mean of Log Transformed Data | -0.443 |
| Standard Deviation of Log Transformed Data | 0.643 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.98 |
| Shapiro Wilk Test Statistic | 0.946 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.768 |
| Lilliefors Test Statistic | 0.175 |
| Lilliefors Critical (0.05) Value | 0.274 |
| Data appear Normal at (0.05) Significance Level | |

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.933 |
| A-D Test Statistic | 0.369 |
| A-D Critical (0.05) Value | 0.726 |
| K-S Test Statistic | 0.172 |
| K-S Critical(0.05) Value | 0.281 |
| Data appear Gamma Distributed at (0.05) Significance Level | |

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.931 |
| Shapiro Wilk Test Statistic | 0.871 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.115 |
| Lilliefors Test Statistic | 0.202 |
| Lilliefors Critical (0.05) Value | 0.274 |
| Data appear Lognormal at (0.05) Significance Level | |

Mercury (eu3)

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 6 | 0 | 6 | 3 | 3 | 50.00% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 3 | 0.041 | 0.056 | 0.046 | 0.041 | 0.00866 |
| Statistics (Non-Detects Only) | 3 | 0.05 | 0.086 | 0.067 | 0.065 | 0.0181 |
| Statistics (All: NDs treated as DL value) | 6 | 0.041 | 0.086 | 0.0565 | 0.053 | 0.0171 |
| Statistics (All: NDs treated as DL/2 value) | 6 | 0.0205 | 0.086 | 0.045 | 0.039 | 0.0268 |
| Statistics (Normal ROS Imputed Data) | 6 | 0.0096 | 0.086 | 0.0444 | 0.0398 | 0.0281 |
| Statistics (Gamma ROS Imputed Data) | 6 | 0.0155 | 0.086 | 0.0462 | 0.0409 | 0.0261 |
| Statistics (Lognormal ROS Imputed Data) | 6 | 0.0274 | 0.086 | 0.0501 | 0.0436 | 0.022 |

| | K hat | K Star | Theta hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | N/A | N/A | N/A | N/A | N/A | N/A |
| Statistics (NDs = DL) | 14.3 | 7.263 | 0.00395 | -2.909 | 0.286 | -0.0984 |
| Statistics (NDs = DL/2) | 3.397 | 1.81 | 0.0132 | -3.255 | 0.614 | -0.189 |
| Statistics (Gamma ROS Estimates) | 3.514 | 1.868 | 0.0131 | -3.224 | 0.622 | -0.193 |
| Statistics (Lognormal ROS Estimates) | -- | -- | -- | -3.07 | 0.425 | -0.138 |

Normal GOF Test Results

| | No NDs | NDs = DL | NDs = DL/ | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 0.995 | 0.948 | 0.953 | 0.987 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilk (Detects Only) | 0.991 | 0.767 | Data Appear Normal |
| Shapiro-Wilk (NDs = DL) | 0.894 | 0.788 | Data Appear Normal |
| Shapiro-Wilk (NDs = DL/2) | 0.889 | 0.788 | Data Appear Normal |
| Shapiro-Wilk (Normal ROS Estimates) | 0.968 | 0.788 | Data Appear Normal |
| Lilliefors (Detects Only) | 0.211 | 0.425 | Data Appear Normal |
| Lilliefors (NDs = DL) | 0.183 | 0.325 | Data Appear Normal |
| Lilliefors (NDs = DL/2) | 0.237 | 0.325 | Data Appear Normal |
| Lilliefors (Normal ROS Estimates) | 0.2 | 0.325 | Data Appear Normal |

Gamma GOF Test Results

| | No NDs | NDs = DL | NDs = DL/ | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | N/A | 0.976 | 0.98 | 0.99 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | N/A | N/A | |
| Kolmogorov-Smirnov (Detects Only) | N/A | N/A | |
| Anderson-Darling (NDs = DL) | 0.302 | 0.698 | |
| Kolmogorov-Smirnov (NDs = DL) | 0.189 | 0.332 | Data Appear Gamma Distributed |
| Anderson-Darling (NDs = DL/2) | 0.384 | 0.701 | |
| Kolmogorov-Smirnov (NDs = DL/2) | 0.233 | 0.334 | Data Appear Gamma Distributed |
| Anderson-Darling (Gamma ROS Estimates) | 0.193 | 0.701 | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | 0.182 | 0.334 | Data Appear Gamma Distributed |

Lognormal GOF Test Results

| | No NDs | NDs = DL | NDs = DL/ | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 1 | 0.968 | 0.959 | 0.987 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilk (Detects Only) | 1 | 0.767 | Data Appear Lognormal |
| Shapiro-Wilk (NDs = DL) | 0.926 | 0.788 | Data Appear Lognormal |
| Shapiro-Wilk (NDs = DL/2) | 0.892 | 0.788 | Data Appear Lognormal |
| Shapiro-Wilk (Lognormal ROS Estimates) | 0.965 | 0.788 | Data Appear Lognormal |
| Lilliefors (Detects Only) | 0.177 | 0.425 | Data Appear Lognormal |
| Lilliefors (NDs = DL) | 0.174 | 0.325 | Data Appear Lognormal |
| Lilliefors (NDs = DL/2) | 0.199 | 0.325 | Data Appear Lognormal |
| Lilliefors (Lognormal ROS Estimates) | 0.2 | 0.325 | Data Appear Lognormal |

Note: Substitution methods such as DL or DL/2 are not recommended.

Mercury (kl)

| | Num Obs | Num Miss | Num Valid | Detects | NDs | % NDs |
|---|---|---|---|---|---|---|
| Raw Statistics | 9 | 0 | 9 | 2 | 7 | 77.78% |

| | Number | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | 7 | 0.011 | 0.054 | 0.0424 | 0.046 | 0.0145 |
| Statistics (Non-Detects Only) | 2 | 0.045 | 0.069 | 0.057 | 0.057 | 0.017 |
| Statistics (All: NDs treated as DL value) | 9 | 0.011 | 0.069 | 0.0457 | 0.046 | 0.0153 |
| Statistics (All: NDs treated as DL/2 value) | 9 | 0.0055 | 0.069 | 0.0292 | 0.0235 | 0.018 |
| Statistics (Normal ROS Imputed Data) | 9 | 0.0104 | 0.069 | 0.0245 | 0.0188 | 0.0198 |
| Statistics (Gamma ROS Imputed Data) | 9 | N/A | N/A | N/A | N/A | N/A |
| Statistics (Lognormal ROS Imputed Data) | 9 | 0.0243 | 0.069 | 0.0333 | 0.0282 | 0.0148 |

| | K hat | K Star | Theta hat | Log Mean | Log Stdv | Log CV |
|---|---|---|---|---|---|---|
| Statistics (Non-Detects Only) | N/A | N/A | N/A | N/A | N/A | N/A |
| Statistics (NDs = DL) | 5.856 | 3.978 | 0.0078 | -3.174 | 0.522 | -0.164 |
| Statistics (NDs = DL/2) | 2.956 | 2.045 | 0.00987 | -3.713 | 0.682 | -0.184 |
| Statistics (Gamma ROS Estimates) | N/A | N/A | N/A | N/A | N/A | N/A |
| Statistics (Lognormal ROS Estimates) | -- | -- | -- | -3.467 | 0.352 | -0.102 |

Normal GOF Test Results

| | No NDs | NDs = DL | NDs = DL/ | Normal ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 1 | 0.894 | 0.895 | 0.842 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilk (NDs = DL) | 0.838 | 0.829 | Data Appear Normal |
| Shapiro-Wilk (NDs = DL/2) | 0.828 | 0.829 | Data Not Normal |
| Shapiro-Wilk (Normal ROS Estimates) | 0.719 | 0.829 | Data Not Normal |
| Lilliefors (Detects Only) | N/A | N/A | |
| Lilliefors (NDs = DL) | 0.294 | 0.274 | Data Not Normal |
| Lilliefors (NDs = DL/2) | 0.326 | 0.274 | Data Not Normal |
| Lilliefors (Normal ROS Estimates) | 0.391 | 0.274 | Data Not Normal |

Gamma GOF Test Results

| | No NDs | NDs = DL | NDs = DL/ | Gamma ROS |
|---|---|---|---|---|
| Correlation Coefficient R | N/A | 0.858 | 0.95 | 0.922 |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Anderson-Darling (Detects Only) | N/A | N/A | |
| Kolmogorov-Smirnov (Detects Only) | N/A | N/A | |
| Anderson-Darling (NDs = DL) | 1.223 | 0.723 | |
| Kolmogorov-Smirnov (NDs = DL) | 0.365 | 0.28 | Data Not Gamma Distributed |
| Anderson-Darling (NDs = DL/2) | 0.65 | 0.727 | |
| Kolmogorov-Smirnov (NDs = DL/2) | 0.257 | 0.281 | Data Appear Gamma Distributed |
| Anderson-Darling (Gamma ROS Estimates) | N/A | 0.72 | |
| Kolmogorov-Smirnov (Gamma ROS Est.) | N/A | 0.279 | |

Lognormal GOF Test Results

| | No NDs | NDs = DL | NDs = DL/ | Log ROS |
|---|---|---|---|---|
| Correlation Coefficient R | 1 | 0.786 | 0.906 | N/A |

| | Test value | Crit. (0.05) | Conclusion with Alpha(0.05) |
|---|---|---|---|
| Shapiro-Wilk (NDs = DL) | 0.655 | 0.829 | Data Not Lognormal |
| Shapiro-Wilk (NDs = DL/2) | 0.855 | 0.829 | Data Appear Lognormal |
| Shapiro-Wilk (Lognormal ROS Estimates) | 0.719 | 0.829 | Data Not Lognormal |
| Lilliefors (Detects Only) | N/A | N/A | |
| Lilliefors (NDs = DL) | 0.392 | 0.274 | Data Not Lognormal |
| Lilliefors (NDs = DL/2) | 0.302 | 0.274 | Data Not Lognormal |
| Lilliefors (Lognormal ROS Estimates) | 0.391 | 0.274 | Data Not Lognormal |

Note: Substitution methods such as DL or DL/2 are not recommended.

Zinc (eu3)

| Raw Statistics | |
|---|---|
| Number of Valid Observations | 6 |
| Number of Distinct Observations | 6 |
| Minimum | 31 |
| Maximum | 44 |
| Mean of Raw Data | 37.17 |
| Standard Deviation of Raw Data | 5.037 |
| Khat | 65.84 |
| Theta hat | 0.565 |
| Kstar | 33.03 |
| Theta star | 1.125 |
| Mean of Log Transformed Data | 3.608 |
| Standard Deviation of Log Transformed Data | 0.135 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.982 |
| Shapiro Wilk Test Statistic | 0.949 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.18 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.983 |
| A-D Test Statistic | 0.243 |
| A-D Critical (0.05) Value | 0.697 |
| K-S Test Statistic | 0.187 |
| K-S Critical(0.05) Value | 0.332 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.986 |
| Shapiro Wilk Test Statistic | 0.956 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.165 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Lognormal at (0.05) Significance Level

Zinc (kl)

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 9 |
| Number of Distinct Observations | 6 |
| Minimum | 29 |
| Maximum | 41 |
| Mean of Raw Data | 36 |
| Standard Deviation of Raw Data | 3.742 |
| Khat | 97.86 |
| Theta hat | 0.368 |
| Kstar | 65.31 |
| Theta star | 0.551 |
| Mean of Log Transformed Data | 3.578 |
| Standard Deviation of Log Transformed Data | 0.109 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.927 |
| Shapiro Wilk Test Statistic | 0.868 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.0964 |
| Lilliefors Test Statistic | 0.278 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data appear Approximate Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.919 |
| A-D Test Statistic | 0.781 |
| A-D Critical (0.05) Value | 0.72 |
| K-S Test Statistic | 0.291 |
| K-S Critical(0.05) Value | 0.279 |

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.915 |
| Shapiro Wilk Test Statistic | 0.846 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.0557 |
| Lilliefors Test Statistic | 0.296 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data appear Approximate_Lognormal at (0.05) Significance Level

## Total PCBs (Congeners) (eu3)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 6 |
| Number of Missing Observations | 6 |
| Number of Distinct Observations | 6 |
| Minimum | 262.5 |
| Maximum | 438.3 |
| Mean of Raw Data | 331.4 |
| Standard Deviation of Raw Data | 62.56 |
| Khat | 35.68 |
| Theta hat | 9.287 |
| Kstar | 17.95 |
| Theta star | 18.46 |
| Mean of Log Transformed Data | 5.789 |
| Standard Deviation of Log Transformed Data | 0.182 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.961 |
| Shapiro Wilk Test Statistic | 0.93 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.232 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.977 |
| A-D Test Statistic | 0.262 |
| A-D Critical (0.05) Value | 0.697 |
| K-S Test Statistic | 0.22 |
| K-S Critical(0.05) Value | 0.332 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.978 |
| Shapiro Wilk Test Statistic | 0.959 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.206 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Lognormal at (0.05) Significance Level

## Total PCBs (Congeners) (kl)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 9 |
| Number of Missing Observations | 9 |
| Number of Distinct Observations | 9 |
| Minimum | 289.6 |
| Maximum | 395.8 |
| Mean of Raw Data | 334.5 |
| Standard Deviation of Raw Data | 40.94 |
| Khat | 77.12 |
| Theta hat | 4.337 |
| Kstar | 51.49 |
| Theta star | 6.496 |
| Mean of Log Transformed Data | 5.806 |
| Standard Deviation of Log Transformed Data | 0.12 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.956 |
| Shapiro Wilk Test Statistic | 0.889 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.304 |
| Lilliefors Test Statistic | 0.189 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.959 |
| A-D Test Statistic | 0.419 |
| A-D Critical (0.05) Value | 0.72 |
| K-S Test Statistic | 0.199 |
| K-S Critical(0.05) Value | 0.279 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.962 |
| Shapiro Wilk Test Statistic | 0.899 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.392 |
| Lilliefors Test Statistic | 0.185 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data appear Lognormal at (0.05) Significance Level

4,4'-DDE (eu3)

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 6 |
| Number of Missing Observations | 6 |
| Number of Distinct Observations | 6 |
| Minimum | 9.8 |
| Maximum | 23 |
| Mean of Raw Data | 15.97 |
| Standard Deviation of Raw Data | 4.657 |
| Khat | 13.55 |
| Theta hat | 1.178 |
| Kstar | 6.888 |
| Theta star | 2.318 |
| Mean of Log Transformed Data | 2.733 |
| Standard Deviation of Log Transformed Data | 0.304 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.984 |
| Shapiro Wilk Test Statistic | 0.971 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.17 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.983 |
| A-D Test Statistic | 0.236 |
| A-D Critical (0.05) Value | 0.698 |
| K-S Test Statistic | 0.206 |
| K-S Critical(0.05) Value | 0.332 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.981 |
| Shapiro Wilk Test Statistic | 0.963 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.218 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Lognormal at (0.05) Significance Level

4,4'-DDE (kl)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 9 |
| Number of Missing Observations | 9 |
| Number of Distinct Observations | 7 |
| Minimum | 10 |
| Maximum | 23 |
| Mean of Raw Data | 17.67 |
| Standard Deviation of Raw Data | 3.742 |
| Khat | 21.06 |
| Theta hat | 0.839 |
| Kstar | 14.12 |
| Theta star | 1.252 |
| Mean of Log Transformed Data | 2.848 |
| Standard Deviation of Log Transformed Data | 0.244 |
| | |
| Normal GOF Test Results | |
| | |
| Correlation Coefficient R | 0.944 |
| Shapiro Wilk Test Statistic | 0.909 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.218 |
| Lilliefors Test Statistic | 0.207 |
| Lilliefors Critical (0.05) Value | 0.274 |
| Data appear Normal at (0.05) Significance Level | |
| | |
| Gamma GOF Test Results | |
| | |
| Correlation Coefficient R | 0.922 |
| A-D Test Statistic | 0.641 |
| A-D Critical (0.05) Value | 0.721 |
| K-S Test Statistic | 0.237 |
| K-S Critical(0.05) Value | 0.279 |
| Data appear Gamma Distributed at (0.05) Significance Level | |
| | |
| Lognormal GOF Test Results | |
| | |
| Correlation Coefficient R | 0.907 |
| Shapiro Wilk Test Statistic | 0.843 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.0413 |
| Lilliefors Test Statistic | 0.254 |
| Lilliefors Critical (0.05) Value | 0.274 |
| Data appear Lognormal at (0.05) Significance Level | |

ENDRIN (eu3)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 6 |
| Number of Missing Observations | 6 |
| Number of Distinct Observations | 6 |
| Minimum | 3.1 |
| Maximum | 6.5 |
| Mean of Raw Data | 4.533 |
| Standard Deviation of Raw Data | 1.26 |
| Khat | 16.18 |
| Theta hat | 0.28 |
| Kstar | 8.204 |
| Theta star | 0.553 |
| Mean of Log Transformed Data | 1.48 |
| Standard Deviation of Log Transformed Data | 0.272 |
| | |
| Normal GOF Test Results | |
| | |
| Correlation Coefficient R | 0.978 |
| Shapiro Wilk Test Statistic | 0.95 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.209 |
| Lilliefors Critical (0.05) Value | 0.325 |
| Data appear Normal at (0.05) Significance Level | |

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.991 |
| A-D Test Statistic | 0.208 |
| A-D Critical (0.05) Value | 0.698 |
| K-S Test Statistic | 0.181 |
| K-S Critical(0.05) Value | 0.332 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.992 |
| Shapiro Wilk Test Statistic | 0.977 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.165 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Lognormal at (0.05) Significance Level

ENDRIN (kl)

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 9 |
| Number of Missing Observations | 9 |
| Number of Distinct Observations | 6 |
| Minimum | 1.6 |
| Maximum | 5.8 |
| Mean of Raw Data | 4.667 |
| Standard Deviation of Raw Data | 1.34 |
| Khat | 8.781 |
| Theta hat | 0.531 |
| Kstar | 5.928 |
| Theta star | 0.787 |
| Mean of Log Transformed Data | 1.482 |
| Standard Deviation of Log Transformed Data | 0.408 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.86 |
| Shapiro Wilk Test Statistic | 0.754 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.00501 |
| Lilliefors Test Statistic | 0.348 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data not Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.79 |
| A-D Test Statistic | 1.272 |
| A-D Critical (0.05) Value | 0.722 |
| K-S Test Statistic | 0.357 |
| K-S Critical(0.05) Value | 0.279 |

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.799 |
| Shapiro Wilk Test Statistic | 0.66 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 4.23E-04 |
| Lilliefors Test Statistic | 0.342 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data not Lognormal at (0.05) Significance Level

Non-parametric GOF Test Results

Data do not follow a discernible distribution at (0.05) Level of Significance

CHLORDANE (TECHNICAL) (eu3)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 6 |
| Number of Missing Observations | 6 |
| Number of Distinct Observations | 5 |
| Minimum | 110 |
| Maximum | 220 |
| Mean of Raw Data | 155 |
| Standard Deviation of Raw Data | 41.83 |
| Khat | 17.43 |
| Theta hat | 8.89 |
| Kstar | 8.828 |
| Theta star | 17.56 |
| Mean of Log Transformed Data | 5.014 |
| Standard Deviation of Log Transformed Data | 0.261 |
| Normal GOF Test Results | |
| Correlation Coefficient R | 0.958 |
| Shapiro Wilk Test Statistic | 0.912 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.225 |
| Lilliefors Critical (0.05) Value | 0.325 |
| Data appear Normal at (0.05) Significance Level | |
| Gamma GOF Test Results | |
| Correlation Coefficient R | 0.976 |
| A-D Test Statistic | 0.333 |
| A-D Critical (0.05) Value | 0.697 |
| K-S Test Statistic | 0.236 |
| K-S Critical(0.05) Value | 0.332 |
| Data appear Gamma Distributed at (0.05) Significance Level | |
| Lognormal GOF Test Results | |
| Correlation Coefficient R | 0.973 |
| Shapiro Wilk Test Statistic | 0.939 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.214 |
| Lilliefors Critical (0.05) Value | 0.325 |
| Data appear Lognormal at (0.05) Significance Level | |

CHLORDANE (TECHNICAL) (kl)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 9 |
| Number of Missing Observations | 9 |
| Number of Distinct Observations | 8 |
| Minimum | 42 |
| Maximum | 210 |
| Mean of Raw Data | 136.6 |
| Standard Deviation of Raw Data | 56.53 |
| Khat | 5.164 |
| Theta hat | 26.44 |
| Kstar | 3.517 |
| Theta star | 38.83 |
| Mean of Log Transformed Data | 4.817 |
| Standard Deviation of Log Transformed Data | 0.515 |
| Normal GOF Test Results | |
| Correlation Coefficient R | 0.978 |
| Shapiro Wilk Test Statistic | 0.947 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.748 |
| Lilliefors Test Statistic | 0.161 |
| Lilliefors Critical (0.05) Value | 0.274 |
| Data appear Normal at (0.05) Significance Level | |

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.944 |
| A-D Test Statistic | 0.356 |
| A-D Critical (0.05) Value | 0.723 |
| K-S Test Statistic | 0.181 |
| K-S Critical(0.05) Value | 0.28 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.941 |
| Shapiro Wilk Test Statistic | 0.888 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.18 |
| Lilliefors Test Statistic | 0.206 |
| Lilliefors Critical (0.05) Value | 0.274 |

Data appear Lognormal at (0.05) Significance Level

HEPTACHLOR EPOXIDE (eu3)

Raw Statistics

| | |
|---|---|
| Number of Valid Observations | 6 |
| Number of Distinct Observations | 6 |
| Minimum | 3.4 |
| Maximum | 7.6 |
| Mean of Raw Data | 4.95 |
| Standard Deviation of Raw Data | 1.703 |
| Khat | 11.12 |
| Theta hat | 0.445 |
| Kstar | 5.67 |
| Theta star | 0.873 |
| Mean of Log Transformed Data | 1.554 |
| Standard Deviation of Log Transformed Data | 0.324 |

Normal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.934 |
| Shapiro Wilk Test Statistic | 0.86 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.271 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.962 |
| A-D Test Statistic | 0.447 |
| A-D Critical (0.05) Value | 0.698 |
| K-S Test Statistic | 0.251 |
| K-S Critical(0.05) Value | 0.332 |

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

| | |
|---|---|
| Correlation Coefficient R | 0.954 |
| Shapiro Wilk Test Statistic | 0.894 |
| Shapiro Wilk Critical (0.05) Value | 0.788 |
| Approximate Shapiro Wilk P Value | N/A |
| Lilliefors Test Statistic | 0.228 |
| Lilliefors Critical (0.05) Value | 0.325 |

Data appear Lognormal at (0.05) Significance Level

HEPTACHLOR EPOXIDE (kl)

| | |
|---|---|
| Raw Statistics | |
| Number of Valid Observations | 9 |
| Number of Distinct Observations | 8 |
| Minimum | 1.5 |
| Maximum | 6.2 |
| Mean of Raw Data | 3.889 |
| Standard Deviation of Raw Data | 1.705 |
| Khat | 5.332 |
| Theta hat | 0.729 |
| Kstar | 3.628 |
| Theta star | 1.072 |
| Mean of Log Transformed Data | 1.261 |
| Standard Deviation of Log Transformed Data | 0.483 |
| | |
| Normal GOF Test Results | |
| | |
| Correlation Coefficient R | 0.954 |
| Shapiro Wilk Test Statistic | 0.892 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.289 |
| Lilliefors Test Statistic | 0.223 |
| Lilliefors Critical (0.05) Value | 0.274 |
| Data appear Normal at (0.05) Significance Level | |
| | |
| Gamma GOF Test Results | |
| | |
| Correlation Coefficient R | 0.939 |
| A-D Test Statistic | 0.505 |
| A-D Critical (0.05) Value | 0.723 |
| K-S Test Statistic | 0.246 |
| K-S Critical(0.05)  Value | 0.28 |
| Data appear Gamma Distributed at (0.05) Significance Level | |
| | |
| Lognormal GOF Test Results | |
| | |
| Correlation Coefficient R | 0.955 |
| Shapiro Wilk Test Statistic | 0.903 |
| Shapiro Wilk Critical (0.05) Value | 0.829 |
| Approximate Shapiro Wilk P Value | 0.317 |
| Lilliefors Test Statistic | 0.233 |
| Lilliefors Critical (0.05) Value | 0.274 |
| Data appear Lognormal at (0.05) Significance Level | |

Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.16/25/2019 2:55:43 PM |
| From File | 2SampleTests_FishInput_a.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Substantial Difference | 0 |
| Selected Null Hypothesis | Sample 1 Mean/Median = Sample 2 Mean/Median (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean/Median <> Sample 2 Mean/Median |

Sample 1 Data: Lead(eu3)
Sample 2 Data: Lead(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 6 | 8 |
| Minimum | 0.23 | 0.13 |
| Maximum | 1.1 | 1.5 |
| Mean | 0.513 | 0.874 |
| Median | 0.445 | 0.83 |
| SD | 0.304 | 0.425 |
| SE of Mean | 0.124 | 0.142 |

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Sample 1 = Mean/Median of Sample 2

| | |
|---|---|
| Sample 1 Rank Sum W-Stat | 33 |
| WMW U-Stat | 12 |
| Mean (U) | 27 |
| SD(U) - Adj ties | 8.485 |
| Lower U-Stat Critical Value (0.025) | 11 |
| Upper U-Stat Critical Value (0.975) | 43 |
| Standardized WMW U-Stat | -1.769 |
| Approximate P-Value | 0.0768 |

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2

Sample 1 Data: Nickel(eu3)
Sample 2 Data: Nickel(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 5 | 8 |
| Minimum | 0.34 | 0.16 |
| Maximum | 0.79 | 1.2 |
| Mean | 0.59 | 0.743 |
| Median | 0.63 | 0.72 |
| SD | 0.198 | 0.356 |
| SE of Mean | 0.0809 | 0.119 |

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 = Mean of Sample 2

| Method | DF | t-Test Value | Lower C.Va t (0.025) | Upper C.Val t (0.975) | P-Value |
|---|---|---|---|---|---|
| Pooled (Equal Variance) | 13 | -0.954 | -2.16 | 2.16 | 0.357 |
| Welch-Satterthwaite (Unequal Va | 12.8 | -1.068 | -2.16 | 2.16 | 0.305 |

Pooled SD: 0.305
Conclusion with Alpha = 0.050
Student t (Pooled): Do Not Reject H0, Conclude Sample 1 = Sample 2
Welch-Satterthwaite: Do Not Reject H0, Conclude Sample 1 = Sample 2

Test of Equality of Variances

| | |
|---|---|
| Variance of Sample 1 | 0.0392 |
| Variance of Sample 2 | 0.127 |

| Numerator DF | Denominator DF | F-Test Value | P-Value |
|---|---|---|---|
| 8 | 5 | 3.224 | 0.213 |

Conclusion with Alpha = 0.05
Two variances appear to be equal

Tarone-Ware Sample 1 vs Sample 2 Comparison Hypothesis Test for Data Sets with Non-Detects

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.16/25/2019 1:54:48 PM |
| From File | 2SampleTests_FishInput_a.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Selected Null Hypothesis | Sample 1 Mean/Median = Sample 2 Mean/Median (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean/Median <> Sample 2 Mean/Median |

Sample 1 Data: Mercury(eu3)
Sample 2 Data: Mercury(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Data | 6 | 9 |
| Number of Non-Detects | 3 | 7 |
| Number of Detects | 3 | 2 |
| Minimum Non-Detect | 0.041 | 0.011 |
| Maximum Non-Detect | 0.056 | 0.054 |
| Percent Non-detects | 50.00% | 77.78% |
| Minimum Detect | 0.05 | 0.045 |
| Maximum Detect | 0.086 | 0.069 |
| Mean of Detects | 0.067 | 0.057 |
| Median of Detects | 0.065 | 0.057 |
| SD of Detects | 0.0181 | 0.017 |
| KM Mean | 0.0545 | 0.025 |
| KM SD | 0.0164 | 0.0208 |

Sample 1 vs Sample 2 Tarone-Ware Test

H0: Mean/Median of Sample 1 = Mean/Median of Sample 2

| | |
|---|---|
| TW Statistic | 1.207 |
| Lower TW Critical Value(0.025) | -1.96 |
| Upper TW Critical Value (0.975) | 1.96 |
| P-Value | 0.227 |

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2
P-Value >= alpha (0.05)

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.16/25/2019 1:56:48 PM |
| From File | 2SampleTests_FishInput_a.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Substantial Difference (S) | 0 |
| Selected Null Hypothesis | Sample 1 Mean = Sample 2 Mean (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean <> Sample 2 Mean |

Sample 1 Data: Zinc(eu3)
Sample 2 Data: Zinc(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 6 | 6 |
| Minimum | 31 | 29 |
| Maximum | 44 | 41 |
| Mean | 37.17 | 36 |
| Median | 36.5 | 37 |
| SD | 5.037 | 3.742 |
| SE of Mean | 2.056 | 1.247 |

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 = Mean of Sample 2

| Method | DF | t-Test Value | Lower C.Va t (0.025) | Upper C.Val t (0.975) | P-Value |
|---|---|---|---|---|---|
| Pooled (Equal Variance) | 13 | 0.516 | -2.16 | 2.16 | 0.614 |
| Welch-Satterthwaite (Unequal Va | 8.6 | 0.485 | -2.262 | 2.262 | 0.64 |

Pooled SD: 4.286
Conclusion with Alpha = 0.050
Student t (Pooled): Do Not Reject H0, Conclude Sample 1 = Sample 2
Welch-Satterthwaite: Do Not Reject H0, Conclude Sample 1 = Sample 2

Test of Equality of Variances

| | |
|---|---|
| Variance of Sample 1 | 25.37 |
| Variance of Sample 2 | 14 |

| Numerator DF | Denominator DF | F-Test Value | P-Value |
|---|---|---|---|
| 5 | 8 | 1.812 | 0.433 |

Conclusion with Alpha = 0.05
Two variances appear to be equal

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.16/25/2019 2:02:08 PM |
| From File | 2SampleTests_FishInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Substantial Difference (S) | 0 |
| Selected Null Hypothesis | Sample 1 Mean = Sample 2 Mean (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean <> Sample 2 Mean |

Sample 1 Data: Total PCBs (Congeners)(eu3)
Sample 2 Data: Total PCBs (Congeners)(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 6 | 9 |
| Minimum | 262.5 | 289.6 |
| Maximum | 438.3 | 395.8 |
| Mean | 331.4 | 334.5 |
| Median | 320.8 | 333.9 |
| SD | 62.56 | 40.94 |
| SE of Mean | 25.54 | 13.65 |

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 = Mean of Sample 2

| Method | DF | t-Test Value | Lower C.Va t (0.025) | Upper C.Val t (0.975) | P-Value |
|---|---|---|---|---|---|
| Pooled (Equal Variance) | 13 | -0.117 | -2.16 | 2.16 | 0.909 |
| Welch-Satterthwaite (Unequal Va | 7.9 | -0.107 | -2.306 | 2.306 | 0.917 |

Pooled SD: 50.365
Conclusion with Alpha = 0.050
Student t (Pooled): Do Not Reject H0, Conclude Sample 1 = Sample 2
Welch-Satterthwaite: Do Not Reject H0, Conclude Sample 1 = Sample 2

Test of Equality of Variances

| | |
|---|---|
| Variance of Sample 1 | 3913 |
| Variance of Sample 2 | 1676 |

| Numerator DF | Denominator DF | F-Test Value | P-Value |
|---|---|---|---|
| 5 | 8 | 2.334 | 0.274 |

Conclusion with Alpha = 0.05
Two variances appear to be equal

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.16/25/2019 2:03:38 PM |
| From File | 2SampleTests_FishInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Substantial Difference (S) | 0 |
| Selected Null Hypothesis | Sample 1 Mean = Sample 2 Mean (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean <> Sample 2 Mean |

Sample 1 Data: 4,4'-DDE(eu3)
Sample 2 Data: 4,4'-DDE(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 6 | 7 |
| Minimum | 9.8 | 10 |
| Maximum | 23 | 23 |
| Mean | 15.97 | 17.67 |
| Median | 16.5 | 19 |
| SD | 4.657 | 3.742 |
| SE of Mean | 1.901 | 1.247 |

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 = Mean of Sample 2

| Method | DF | t-Test Value | Lower C.Va t (0.025) | Upper C.Val t (0.975) | P-Value |
|---|---|---|---|---|---|
| Pooled (Equal Variance) | 13 | -0.783 | -2.16 | 2.16 | 0.447 |
| Welch-Satterthwaite (Unequal Va | 9.2 | -0.748 | -2.262 | 2.262 | 0.473 |

Pooled SD: 4.118
Conclusion with Alpha = 0.050
Student t (Pooled): Do Not Reject H0, Conclude Sample 1 = Sample 2
Welch-Satterthwaite: Do Not Reject H0, Conclude Sample 1 = Sample 2

Test of Equality of Variances

| | |
|---|---|
| Variance of Sample 1 | 21.69 |
| Variance of Sample 2 | 14 |

| Numerator DF | Denominator DF | F-Test Value | P-Value |
|---|---|---|---|
| 5 | 8 | 1.549 | 0.554 |

Conclusion with Alpha = 0.05
Two variances appear to be equal

Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.16/25/2019 2:05:57 PM |
| From File | 2SampleTests_FishInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Substantial Difference | 0 |
| Selected Null Hypothesis | Sample 1 Mean/Median = Sample 2 Mean/Median (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean/Median <> Sample 2 Mean/Median |

Sample 1 Data: ENDRIN(eu3)
Sample 2 Data: ENDRIN(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 6 | 6 |
| Minimum | 3.1 | 1.6 |
| Maximum | 6.5 | 5.8 |
| Mean | 4.533 | 4.667 |
| Median | 4.25 | 5.3 |
| SD | 1.26 | 1.34 |
| SE of Mean | 0.514 | 0.447 |

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Sample 1 = Mean/Median of Sample 2

| | |
|---|---|
| Sample 1 Rank Sum W-Stat | 45.5 |
| WMW U-Stat | 24.5 |
| Mean (U) | 27 |
| SD(U) - Adj ties | 8.447 |
| Lower U-Stat Critical Value (0.025) | 11 |
| Upper U-Stat Critical Value (0.975) | 43 |
| Standardized WMW U-Stat | -0.296 |
| Approximate P-Value | 0.767 |

Conclusion with Alpha = 0.05
Do Not Reject H0, Conclude Sample 1 = Sample 2

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.16/25/2019 2:09:44 PM |
| From File | 2SampleTests_FishInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Substantial Difference (S) | 0 |
| Selected Null Hypothesis | Sample 1 Mean = Sample 2 Mean (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean <> Sample 2 Mean |

Sample 1 Data: CHLORDANE (TECHNICAL)(eu3)
Sample 2 Data: CHLORDANE (TECHNICAL)(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 5 | 8 |
| Minimum | 110 | 42 |
| Maximum | 220 | 210 |
| Mean | 155 | 136.6 |
| Median | 140 | 130 |
| SD | 41.83 | 56.53 |
| SE of Mean | 17.08 | 18.84 |

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 = Mean of Sample 2

| Method | DF | t-Test Value | Lower C.Va t (0.025) | Upper C.Val t (0.975) | P-Value |
|---|---|---|---|---|---|
| Pooled (Equal Variance) | 13 | 0.681 | -2.16 | 2.16 | 0.508 |
| Welch-Satterthwaite (Unequal Va | 12.8 | 0.725 | -2.16 | 2.16 | 0.481 |

Pooled SD: 51.378
Conclusion with Alpha = 0.050
Student t (Pooled): Do Not Reject H0, Conclude Sample 1 = Sample 2
Welch-Satterthwaite: Do Not Reject H0, Conclude Sample 1 = Sample 2

Test of Equality of Variances

| | |
|---|---|
| Variance of Sample 1 | 1750 |
| Variance of Sample 2 | 3196 |

| Numerator DF | Denominator DF | F-Test Value | P-Value |
|---|---|---|---|
| 8 | 5 | 1.826 | 0.526 |

Conclusion with Alpha = 0.05
Two variances appear to be equal

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.16/25/2019 2:13:22 PM |
| From File | 2SampleTests_FishInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Substantial Difference (S) | 0 |
| Selected Null Hypothesis | Sample 1 Mean = Sample 2 Mean (Two Sided Alternative) |
| Alternative Hypothesis | Sample 1 Mean <> Sample 2 Mean |

Sample 1 Data: HEPTACHLOR EPOXIDE(eu3)
Sample 2 Data: HEPTACHLOR EPOXIDE(kl)

Raw Statistics

| | Sample 1 | Sample 2 |
|---|---|---|
| Number of Valid Observations | 6 | 9 |
| Number of Distinct Observations | 6 | 8 |
| Minimum | 3.4 | 1.5 |
| Maximum | 7.6 | 6.2 |
| Mean | 4.95 | 3.889 |
| Median | 4.25 | 3.2 |
| SD | 1.703 | 1.705 |
| SE of Mean | 0.695 | 0.568 |

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 = Mean of Sample 2

| Method | DF | t-Test Value | Lower C.Va t (0.025) | Upper C.Val t (0.975) | P-Value |
|---|---|---|---|---|---|
| Pooled (Equal Variance) | 13 | 1.181 | -2.16 | 2.16 | 0.259 |
| Welch-Satterthwaite (Unequal Va | 10.9 | 1.182 | -2.201 | 2.201 | 0.263 |

Pooled SD: 1.704
Conclusion with Alpha = 0.050
Student t (Pooled): Do Not Reject H0, Conclude Sample 1 = Sample 2
Welch-Satterthwaite: Do Not Reject H0, Conclude Sample 1 = Sample 2

Test of Equality of Variances

| | |
|---|---|
| Variance of Sample 1 | 2.899 |
| Variance of Sample 2 | 2.909 |

| Numerator DF | Denominator DF | F-Test Value | P-Value |
|---|---|---|---|
| 8 | 5 | 1.003 | 1.047 |

Conclusion with Alpha = 0.05
Two variances appear to be equal

# Attachment C

# Estimation of Biologically Active Zone at Pepco–Benning Road Facility, Washington, DC, Using Sediment Profile Imaging, May 2017

**From:** Patil, Apurva (DOEE) [mailto:apurva.patil@dc.gov]
**Sent:** Monday, June 05, 2017 9:50 AM
**To:** Mahvi, Fariba:(PHI)
**Cc:** Shupe, Mark; Damera, Ravi
**Subject:** RE: Benning RI/FS - Estimation of Biologically Active Zone (BAZ) using Sediment Profile Imaging

Good Morning Fariba,

DOEE concurs the surface sampling of 10 cm for BAZ. Please note that, DOEE will consider the higher detected concentrations for nature and extent determination out of 2013-14 and 2017 sampling data.

Please let me know if you have questions,

Thanks,

Apurva

Apurva Patil, P.E.
Remedial Project Manager
Remediation & Site Response Program
Toxic Substances Division
Department of Energy & Environment
Government of the District of Columbia
1200 First Street NE, 5th Floor
Washington, DC 20002
Desk : (202) 654-6004
Web: doee.dc.gov

# Estimation of Biologicaliy Active Zone at Pepco–Benning Road Facility, Washington, DC, Using Sediment Profile Imaging, May 2017.

**By**

**RJ Diaz and Daughters**

## Introduction

The concern at the Pepco–Benning Road Facility is exposure of benthic organisms to contaminants associated with sediments. Design of a ecological risk assessment plan for benthic organisms requires defining the portion of the sediment column that represents the biologically active zone (BAZ). Knowing the depth of the BAZ is necessary when evaluating sediment concentrations and calculating risks to exposed communities, and to delineate the relevant depth of sediment for remediation (USEPA 2015).

While sediment mixing is driven by both biological and physical processes (Swift et al. 1996, François et al. 2002), the focus of this study is to assess the depth of the BAZ. Within the BAZ organisms mix sediment primarily through feeding activities and movement. This biological process is known as bioturbation (Rhoads 1974). In areas of high sedimentation or physical sediment instability, however, bioturbation becomes less important and physical processes can dominate sediment mixing (McCall and Tevesz 1982, Mermillod-Blondin 2011).

For this study the depth of the BAZ is defined to extend from the sediment-water interface down into the sediment to 80% of the maximum depth of the subsurface biogenic structure. This definition is in accord with US EPA guidelines for determining biologically relevant sampling depths for aquatic ecological risk assessment (USEPA 2015). The BAZ includes both the biodiffusive and bioadvective components of bioturbation (Guinasso and Schink 1975). The primary biogenic structures used to define the BAZ are burrows and the presence of fauna. Infauna act as either biodiffusors essentially randomly mixing sediment by free burrowing, like oligochaetes (Fisher et al. 1980), or bioadvectors with more permanently occupied burrows that can penetrate deeper into the sediment, like some chrinomids (François et al. 2002, Bornstoff et al. 1996).

Biogenic structures and activities of benthos, such as subsurface feeding, surface defecation and burrowing can be observed *in situ* with the use of a sediment profile camera developed by Rhoads and Cande (1971) to investigate processes structuring the sediment-water interface. Sediment profile imaging (SPI) has allowed for the development of a better understanding of the complexity of sediment dynamics from biological and physical points of view (Germano et al. 2011). Data from SPI can be used to estimate the BAZ by measuring the depth within the sediment to which biogenic structures extend. For example, using SPI images Diaz et al. (1994) estimated the BAZ to be 6 to 18 cm on the continental slope off North Carolina. These estimates were comparable to mixed layer depths derived from X-ray images of sediment cores (6 to 20 cm, Diaz et al. 1994) and 210Pb isotope profiles (4 to 12 cm, DeMaster et al. 1994). Solan et al. (2004) also used SPI images to estimate the effect of loss of functional biodiversity on the biogenic mixing depth, similar to the BAZ in this study.

## Methods

### Field Sampling

On 17 May 2017 a sediment profile camera survey was conducted at the Pepco–Benning Road Facility site in Washington DC, on the Anacostia River. A total of 15 stations were sampled near the facility (Figure 1) and five stations sampled north of the facility as background (Figure 2). At each station, a digital sediment profile camera system was deployed to obtain one SPI.

The profile camera used a Canon 7D single lens reflex camera and captured 18-megapixel images onto internal memory card using Canon's raw image format. The profile camera prism window was 15 cm wide and 30 cm tall. The profile camera was controlled from the surface vessel via a cable that supplied power and allowed monitoring of the Canon 7D operation and image capture in real-time. The camera was triggered from the surface about 1-sec after bottom contact and after the prism stopped penetrating the sediment. One hundred (100) pounds of lead was added to the camera frame to increase prism penetration. At shallow stations additional force was placed on the prism by stand on the top of the camera frame. More detail on sediment profile camera operation can be found in Rhoads and Cande (1971) and Germano et al. (2011). As SPI images were collected, they were downloaded onto a laptop computer and assessed for quality while still on site.

### Image Analysis

All SPI were evaluated visually with data on all features recorded in a pre-formatted spreadsheet file. Then images were digitally processed using histogram equalization and 0.1 to 1% histogram clipping to enhance contrast and color for determination of the oxic sediment layer depth with Adobe PhotoShop®. Data from each image were sequentially saved to a spreadsheet file for later analysis. Details of how these data were obtained can be found in Diaz and Schaffner (1988) and Rhoads and Germano (1986). A description of each parameter measured and evaluated follows.

**Prism Penetration** - This parameter provided a geotechnical estimate of sediment compaction with the profile camera prism acting as a dead weight penetrometer. The further the prism entered into the sediment the less compact the sediment is. Penetration was measured as the distance the sediment moved up the 30 cm length of the prism faceplate.

**Sediment Oxidation State** - The oxidation state of the sediment is an important parameter for estimating benthic habitat conditions and relates directly to the quality of the habitat (Pearson and Rosenberg 1978). The reduction-oxidation state of tidal freshwater sediments is related to a complex biogeochemistry that is controlled by a combination of factors ranging from sediment grain size, organic content, microbial communities, bioturbation, sediment sulfate concentration, and oxygen availability. The biogeochemistry reactions follow a consistent pattern with oxidants consumed in order of decreasing energy production per mole of organic carbon oxidized (Oxygen > manganese oxides and nitrate > iron oxides > sulfate) (Froelich et al. 1979). Fortunately, these biogeochemical states are relatively colorful, with oxic sediments being brown to reddish-brown, suboxic sediments being olive-brown to light-gray, and anoxic sediments being darker-gray. This is the basis for the well-known qualitative relationship between sediment color and its reduction-oxidation state (Bull and Williamson 2001). It is assumed that given the complexities of manganese, iron, and sulfate reduction-oxidation chemistry the reddish-brown sediment color tones indicate sediments contain oxygen and are in an oxidative geochemical state, or at least are not intensely reducing (Fenchel 1969, Bull and Williamson 2001).

The oxic zone at the surface of sediments is usually very thin (Jørgensen and Revsbech 1985). The thickness of the apparent oxic layer depth (aOLD) includes the oxic portion of the surface sediments and also sediments appear to be suboxic. The term apparent is used in describing this parameter because with SPI no actual measurement is made of oxygen or reduction-oxidation potential. Color in SPI, however, is also dependent on sediment mineralogy and nonsedimentary factors such as ambient water column light, reflections, and shadows that can make parts of the image seem lighter or darker. Thus sediments visually assessed as oxic do not necessarily contain free oxygen, nor do visually anoxic sediments necessarily contain free sulfides (Wetzel 1995). The number of pixels in the user-defined oxic layer was counted and converted to linear measurement by dividing by the width of the image used in the analysis to arrive at an average aOLD depth.

**Sediment Grain Size** - Grain size is an important parameter for determining the nature of the physical forces acting on the bottom and is one of the major factors in determining benthic community composition (Rhoads 1974, Snelgrove and Butman 1994). The sediment type descriptors used for image analysis follow the Wentworth classification as described in Folk (1974) and represent the major modal class for each image. Grain size was determined by comparison of collected images with a set of standard images for which mean grain size had been determined in the laboratory.

**Surface Features** - These parameters include a wide variety of physical (such as bedforms) and biological features (such as biogenic mounds, shell, or tubes). The presence of certain surface features is indicative of the overall nature of the processes acting on surface sediment.

Surface features were visually evaluated from each image and compiled by type and frequency of occurrence.

**Subsurface Features** - Subsurface features include a wide variety of structures (such as infaunal organisms, burrows, water or gas filled voids, and sediment layering) that reveal the importance of physical and biological processes influencing the bottom. Subsurface features were visually evaluated from each image and compiled by type and frequency of occurrence.

**Biologically Active Zone (BAZ)**

The depth of the BAZ was inferred from SPI images based on two key features:

1) Thickness of the apparent oxic zone.
2) Depth to which various biogenic structures occurred.

Figure 3 shows the relationship between SPI defined BAZ depth and the mixing compartments defined by Swift et al. (1996) and François et al. (2002). The base of the BAZ being zone of transition in the Swift et al. model (1996) or tube bottom zone in the François et al. model (2002). Following US EPA guidelines for determining biologically relevant sampling depths (USEPA 2015), the depth of the BAZ was then defined to extend from the sediment surface down into the sediment to 80th percentile of the maximum depth of infaunal presence or the depth of the aOLD, whichever was deeper.

In the case of SPI data that provides only one point for the maximum depth of infauna, 80% of the maximum infaunal depth was used as an estimate of the 80th percentile. For example, at Station SED8C penetration was 28.7 cm, the aOLD was 1.7 cm, and three infauna were observed with a maximum depth (Max Depth) of 7.5 cm from the sediment surface (Tables 2 and 3). The infauna were deeper than the aOLD so the estimated BAZ for this station would then be: 7.5 x 80% = 6.0 cm.

## Results and Discussion

Modal sediment grain-size at the Pepco–Benning Road Facility site and Anacostia River SPI stations ranged from soft silt-clay to compact very-fine-sand with 10 of 20 stations being all silt-clay. There appeared to be some medium-sand mixed in with silt-clay at Stations SED6.5D and SED7E (Table 2). The coarsest sediments of fine-sand occurred at center channel Station SEDBACK19. Shallowest prism penetration of 2.2 cm was at Station SEDBACK18 that had very-fine-sand-silt-clay that appeared to overlaid gravelly sediments (Figure 4). Deepest penetration of 28.7 cm occurred at Station SED8C that was all silt-clay.

About half of the stations had sediment layers. Stations SED6.5D and SED7E had layered sediments that were of different grain-sizes with uniform silt-clays at the sediment surface over what appeared to be sandy silt-clays. The other five stations with layered sediments were all silt-clay with layers that were different color or texture (Figure 4, Table 2).

In silt-clay sediments, such as those found at all stations, physical diffusion typically limits oxygen penetration to <1 cm in the absence of resuspension and bioturbation (Jørgensen and Revsbech 1985). Physical diffusion may have limited the apparent oxygen layer depth (aOLD) at Stations SED7.5D and SED7F, which were 0.4 cm and 0.7 cm, respectively. At all other stations the aOLD was 1.0 cm or greater and ranged from 1.0 cm at Station SED7B to 5.0 cm at Station SED7.5E (Table 3). But it did not appear that bioturbation was the primary factor for the deepening the aOLD at any station. Sediment that comprised the aOLD layer appeared to be either uniform in texture with little evidence of bioturbation that would impart a textured appearance to the sediments from burrows or tube structures (Rhoads 1974) or had fine particles of detritus mixed in.

The sediment surface at all stations appeared to be dominated by physical processes with little indication of biological processes, such as bioturbation, being important. What appeared to be small tubes (<1 mm in diameter) that could belong to chironomids or could be plant roots protruding form an eroded surface occurred at Stations SED6B and SED8B (Table 3). Oligochaetes, which are the dominant faunal group in the Anacostia River and other tidal freshwater tributaries in Chesapeake Bay (Diaz 1989, 1994, Dauer 1993), do not build tubes (Brinkhurst and Jamieson 1971) or ventilate their burrows (Fisher et al. 1980, McCall and Fisher 1980), which would oxidize the burrow walls and make them more visible in the SPI images.

The most obvious signs of biogenic activity were gas voids produced by anaerobic methanogenic microbes. When sediment sulphate is depleted, methanogenesis becomes the dominating diagenetic process producing methane and carbon dioxide (Fenchel 1987, Kristensen 2000). Gas voids occurred at 14 of 15 stations around the Pepco–Benning Road Facility, only Station SED7B did not have visible gas voids, but this may have been related to shallow prism penetration. Of the five background stations only SEDBACK16 had gas voids. During sampling gas bubbles were observed coming to the water surface as the prism penetrated the sediment at all stations. The most gassy station was SEDBACK16 with two gas bubbles traces in the water column and one bubble on the sediment surface of the SPI image (Figure 4). Gas voids were observed throughout the sediment column from near the sediment surface to the bottom of prism penetrations (Figure 4).

Infauna, which all appeared to be oligochaetes, were observed below the sediment surface at 14 of 15 stations around the Pepco–Benning Road Facility only Station SED7.5D did not have infauna visible. No infauna was observed at any of the five background stations, SEDBACK16 to SEDBACK20 (Table 3). Infauna were all small on the order 0.5 mm in diameter. There was no evidence of burrowing by any other infaunal species, such as Chironomid larvae that are common in tidal freshwater and low salinity habitats (Diaz 1989, Bonsdorff et al. 1996). The only non-oligochaete species observed was a *Corbicula* clam at the sediment surface of Stations SED7B.

In line with sediment mixing models, the depth to which infauna were observed in SPI was used as the maximum depth of the bottom of the BAZ layer. This would encompass the zones of mixing and resuspension in the Swift et al. (1996) model, and biodiffusion and tube bottom zones in the François et al. (2002) model. And following US EPA guidelines for determining biologically relevant sampling depths (USEPA 2015), the final depth for the BAZ was defined to extend from the sediment surface down into the sediment to 80% of the maximum depth of the aOLD or infauna, whichever was deeper.

At the 15 stations around the Pepco–Benning Road Facility the estimated BAZ ranged from 0.4 cm at Station SED7.5D to 15.5 cm at Stations SED7A. The two shallowest BAZ values were <2 cm and based only on aOLD layer depths at Stations SED7.5D and SED7B. Of the five background stations, only SEDBACK17 and SEDBACK19 had estimated BAZ values of 1.3 cm and 2.4 cm, respectively, which were both based on the depth of the aOLD as no infauna was observed at either station. For the other three background stations; Station SEDBACK16 sediments were completely mixed by gas bubbling percolating out of the sediment during sampling, Station SEDBACK20 sediments were composed of entirely of leaves and detritus with some silt-clay mixed in, and Station SEDBACK18 prism penetration was too shallow to observe the aOLD layer (Figure 4).

As prism penetration is the key parameter for allowing the unbiased determination of the BAZ depth, stations were grouped into three categories for penetration (<5 cm, 10-15 cm, and >15 cm) and the average BAZ calculated, not including the background stations for reasons stated above. The three site stations with <10 cm penetration had an average BAZ of 2.4 cm, at the four stations with 10-15 cm penetration the average BAZ was 8.2 cm, and for the eight >15 cm penetration the average BAZ was 10.5 cm (Tables 2, 3, and 4). The depth of the BAZ is underestimated when penetration is under 10 cm. Based on analysis of variance, the three categories are significantly different (ANOVA df = 2, F = 7.10, p = 0.009). Pairwise comparison of the mean BAZ estimates indicated the mean for <10 cm category was significantly lower than the means for both the 10-15 and >15 cm categories, and the 10-15 and >15 cm categories were not significantly different.

Stations with penetration >10 cm provide the best estimation of the BAZ. While there was no statistical difference between 10-15 and >15 cm penetration categories, the best unbiased estimate of BAZ at the Pepco–Benning Road Facility site is represented by the >15 cm category, which is 10.5 cm (SD = 3.6 cm) with a coefficient of variation of 35% and a 95% confidence interval of 7.5 to 13.6 cm.

**Summary**

Sediments at the Pepco–Benning Road Facility site and Anacostia River stations appeared to be typical for tidal freshwater systems within Chesapeake Bay (Diaz 1989, 1994, Clarke et al. 2003).

The dominance of surfical sediments by physical processes appeared to be the principal factor determining reduction-oxidation state of the sediments and the depth of the apparent oxic layer depth (aOLD). There was no evidence of surface sediment bioturbation by infauna at any of the Pepco–Benning Road Facility or Anacostia River stations. All infauna observed in sediment profile images (SPI) appeared to be free-burrowing oligochaetes, which dominate faunal abundance at the site (Preliminary Findings from Grab Samples)

The biologically active zone (BAZ) layer was inferred from SPI based on two key parameters:

1) Thickness of the apparent oxic zone (aOLD).
2) Maximum depth to which infauna were observed (Max Infauna).

Following US EPA guidelines for determining biologically relevant sampling depths (USEPA 2015), the depth of the BAZ was then defined to extend from the sediment surface down into the sediment to 80% of the maximum depth of the aOLD zone or infauna, whichever was deeper.

For stations at the Pepco–Benning Road Facility site, prism penetration did affect the estimated BAZ depth with <10 cm of penetration leading to significantly shallower BAZ estimates. Stations with penetration >10 cm provide the best estimation of the BAZ. While there was no statistical difference between 10-15 and >15 cm penetration categories, the best unbiased estimate of BAZ is represented by the >15 cm category, which is 10.5 cm (SD = 3.6 cm) with a coefficient of variation of 35% and a 95% confidence interval of 7.5 to 13.6 cm.

Based on the SPI analysis and interpretation, setting the BAZ at 10 cm would be sufficient to set a relevant sampling depth for planning ecological risk assessment purposes at both the Pepco–Benning Road Facility site and at background stations in the Anacostia River.

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Table 1. Location of SPI stations at the Pepco–Benning Road Facility site on the Anacostia River, 17 May 2017.

| Station | Easting | Northing |
|---|---|---|
| SED6.5D | 1323798.174 | 449651.750 |
| SED6.5E | 1323969.787 | 449649.357 |
| SED6A | 1323401.290 | 449707.180 |
| SED6B | 1323424.780 | 449687.440 |
| SED6C | 1323525.050 | 449590.240 |
| SED7.5D | 1323906.868 | 449865.943 |
| SED7.5E | 1324043.583 | 449782.676 |
| SED7A | 1323526.840 | 449965.980 |
| SED7B | 1323647.810 | 449847.440 |
| SED7D | 1323814.315 | 449789.579 |
| SED7E | 1324057.630 | 449708.440 |
| SED7F | 1324119.871 | 449660.560 |
| SED8A | 1323631.740 | 450169.600 |
| SED8B | 1323699.750 | 450124.440 |
| SED8C | 1323810.540 | 450062.600 |
| SEDBACK16 | 1329537.223 | 461604.984 |
| SEDBACK17 | 1329694.294 | 459355.757 |
| SEDBACK18 | 1329624.892 | 456841.702 |
| SEDBACK19 | 1328366.675 | 455288.814 |
| SEDBACK20 | 1325572.090 | 454297.430 |

Table 2. SPI data from Pepco–Benning Road Facility, Washington, DC, May 2017.

| Station | Prism Penetration (cm) | Grain-Size | Sediment Description |
|---|---|---|---|
| SED6.5D | 21.7 | SICL/ FSMSSICL /SICL | Brown surface sediment over 11.9 cm light gray uniform textured silt-clay layer over 5.6 cm sandy mud and detritus layer over darker gray clayey sediment. Many small gas voids mostly in sandy mud layer. |
| SED6.5E | 21.5 | SICL/SICL | Brown surface sediment with some detritus mixed in over 5.4 cm dark gray silt-clay layer over light colored mottled silt-clay, Microalgae on sediment surface. Many small gas voids mostly in mottled silt-clay. |
| SED6A | 12.2 | SICL/SICL | 1.3 cm light brown flocculent layer with some detritus mixed in over lighter brown uniform textured silt-clay with some mottled sediment at bottom of image. Many small gas voids. |
| SED6B | 10.3 | SICL | Light brown surface sediment over lighter brown uniform textured silt-clay with some mottled sediment at bottom of image. Many small to medium gas voids. Sediment surface has many biogenic structures that appear to be small tubes. |
| SED6C | 17.8 | SICL/SICL | Light brown surface sediment over 9.6 cm layer of uniform textured light brown silt-clay over mottled silt-clay. Many small to medium gas voids mostly in uniform silt-clay. Aquatic vegetation present. |
| SED7.5D | 4.1 | SICL | Uneven surface of brown and gray silt-clay sediment. Several medium gas voids present. |
| SED7.5E | 21.8 | SICL/SICL | 6.2 cm layer of brown surface silt-clay with detritus over 5.7 cm light gray silt-clay layer over darker gray mottled silt-clay. Some small gas voids mostly in mottled silt-clay. Microalgae on sediment surface. |
| SED7A | 25.8 | SICL | Light brown surface over lighter brown uniform textured silt-clay. Many small to medium gas voids scattered throughout sediment. Gas bubble and plum of sediment streaming form surface. |
| SED7B | 6.1 | SICL | Uneven surface of brown and gray silt-clay sediment. Corbicula clam sitting on sediment surface. No gas voids but there are several water filled voids. |
| SED7D | 25.3 | SICL | Brown flocculent surface sediment with leaves over lighter mottled brown/gray silt-clay. Many small to medium gas voids with gas tracks that look like biogenic burrows but are not. |
| SED7E | 21.6 | SICL/ FSMSSICL | Light brown surface over 17.3 cm light gray silt-clay over darker brown sandy mud. Many small to medium gas voids mostly in sandy mud sediments. Microalgae on sediment surface. |
| SED7F | 12.5 | SICL | Light gray surface sediment with detritus over light brown mottled silt-clay. Aquatic vegetation present with microalgae on sediment surface. |
| SED8A | 12.6 | SICL | Light brown surface over lighter brown/gray uniform textured silt-clay. Many small to medium gas voids spread throughout sediment. |
| SED8B | 8.6 | SICL | Light brown surface with detritus and leaves over light brown/gray silt-clay with detritus. Many small to medium gas voids. Sediment surface has some biogenic structures that appear to be small tubes. |
| SED8C | 28.7 | SICL/SICL | Brown surface sediment over 5.8 cm light brown/gray silt-clay layer over darker gray mottled silt-clay. Many small to medium gas voids throughout sediment with gas tracks that look like biogenic burrows but are not. |
| SEDBACK16 | 13.8 | SICL | Very gassy brown sediment that is mostly detritus. Gas bubbles rising to water surface carrying plums of sediment into the water column. |
| SEDBACK17 | 7.4 | VFSSICL | Light brown sediment with flocculent surface. One water filed void and no gas voids. |
| SEDBACK18 | 2.2 | VFSSICL | Light brown compact uniform sediment with flocculent surface. |
| SEDBACK19 | 6.9 | FS | Light brown sand sediment with trace of silt-clay and detritus. Thin layer of flocculent surface sediment. Sediment surface has some biogenic structures that appear to be small tubes. |
| SEDBACK20 | 10.0 | SICL | Light brown sediment mostly whole leaves and detritus. |

Grain-Size: CL = Clay, FS = Fine-Sand, MS = Medium-Sand, SI = Silt, VFS = Very-Fine-Sand

Table 3. SPI data and BAZ estimates from Pepco–Benning Road Facility, Washington, DC, May 2017.

| | aOLD | Tubes | Infauna | Min Depth | Max Depth | Burrows | Oxic Voids | Anaerobic Voids | Gas Voids | BAZ |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | (cm) | (#/image) | (#/image) | (cm) | (cm) | (#/image) | (#/image) | (#/image) | (#/image) | (cm) |
| SED6.5D | 1.9 | 0 | 2 | 8.2 | 12.8 | 0 | 0 | 0 | 25-49 | 10.3 |
| SED6.5E | 2.0 | 0 | 2 | 8.0 | 10.8 | 0 | 0 | 0 | 25-49 | 8.7 |
| SED6A | 1.3 | 0 | 6 | 4.5 | 12.8 | 0 | 0 | 0 | 25-49 | 10.2 |
| SED6B | 1.5 | 25-49 | 8 | 4.3 | 10.9 | 0 | 0 | 0 | 25-49 | 8.7 |
| SED6C | 1.7 | 0 | 4 | 0.3 | 17.8 | 0 | 0 | 0 | 25-49 | 14.3 |
| SED7.5D | 0.4 | 0 | 0 | | | 0 | 0 | 0 | 1-9 | 0.4 |
| SED7.5E | 5.0 | 0 | 1 | 6.9 | 6.9 | 0 | 0 | 0 | 10-24 | 5.5 |
| SED7A | 1.8 | 0 | 5 | 8.5 | 19.3 | 0 | 0 | 0 | >50 | 15.5 |
| SED7B | 1.0 | 0 | 1 | 0.4 | 0.4 | 0 | 0 | 7 | 0 | 0.8 |
| SED7D | 1.6 | 0 | 6 | 5.4 | 14.7 | 0 | 0 | 0 | 25-49 | 11.8 |
| SED7E | 1.7 | 0 | 10 | 7.5 | 15.1 | 0 | 0 | 0 | 10-24 | 12.1 |
| SED7F | 0.7 | 0 | 5 | 2.4 | 7.8 | 0 | 0 | 0 | 1-9 | 6.3 |
| SED8A | 2.8 | 0 | 2 | 8.2 | 9.4 | 0 | 0 | 0 | 25-49 | 7.5 |
| SED8B | 2.0 | 10-24 | 2 | 7.5 | 7.7 | 0 | 0 | 0 | 25-49 | 6.1 |
| SED8C | 1.7 | 0 | 3 | 4.4 | 7.5 | 0 | 0 | 0 | 25-49 | 6.0 |
| SEDBACK 16 | IND | 0 | 0 | | | 0 | 0 | 0 | 1-9 | IND |
| SEDBACK 17 | 1.6 | 0 | 0 | | | 0 | 0 | 1 | 0 | 1.3 |
| SEDBACK 18 | IND | 0 | 0 | | | 0 | 0 | 0 | 0 | IND |
| SEDBACK 19 | 3.0 | 10-24 | 0 | | | 0 | 0 | 0 | 0 | 2.4 |
| SEDBACK 20 | IND | 0 | 0 | | | 0 | 0 | 0 | 0 | IND |

aOLD = apparent oxic layer depth, Min Depth = minimum depth of infauna, Max Depth = maximum depth of infauna, BAZ = biologically active zone, IND = Indeterminate. See text for explanations.

Table 4. Summary of estimated BAZ layer depth by prism penetration categories for Pepco–Benning Road Facility, Washington, DC, May 2017.

| Prism Penetration | Mean (cm) | SD (cm) | CV (%) |
|---|---|---|---|
| **<10 cm** | 2.4 | 3.2 | 133 |
| **10-15 cm** | 8.2 | 1.7 | 21 |
| **>15 cm** | 10.5 | 3.6 | 35 |

SD = Standard Deviation

CV = Coefficient of Variation

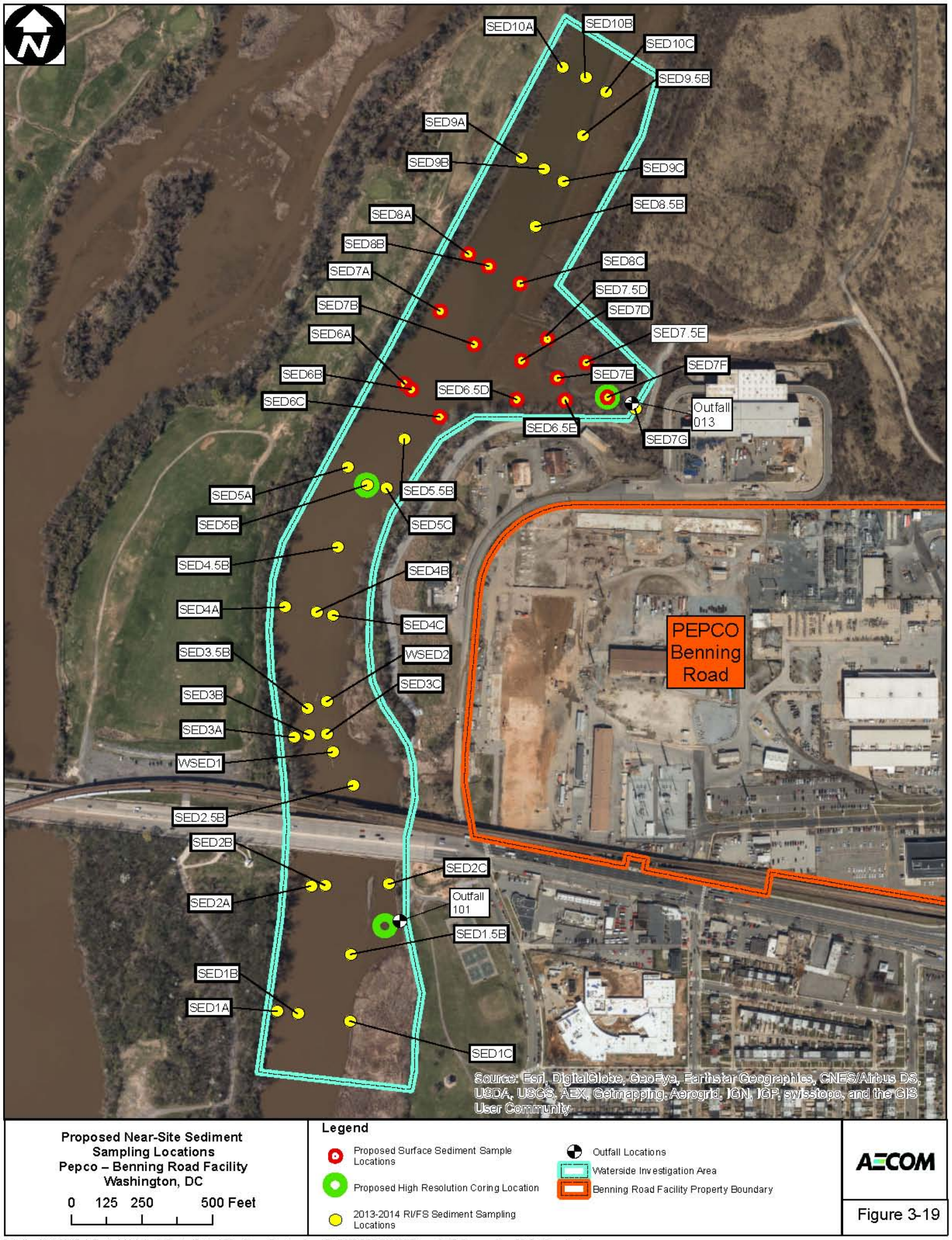


Figure 1. Location of Sediment Profile Imaging stations at Pepco–Benning Road Facility, Washington, DC, May 2017.


Figure 2. Location of Sediment Profile Imaging background stations at Pepco–Benning Road Facility, Washington, DC, May 2017.

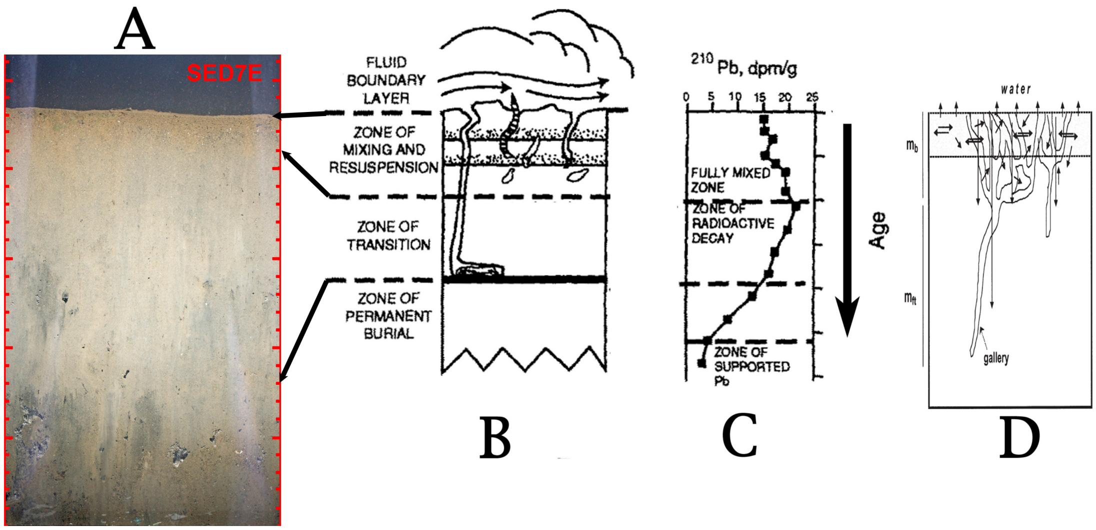


Figure 3. Relationship between SPI derived BAZ and biologically mixing models: A – SPI image from Station SED7E. B – Biogenic mixing zone model of Swift et al. (1996). C – Example of a $^{210}Pb$ profile that matches the Swift et al. (1996) model. D – Two part mixing model of François et al. (2002), $m_b$ is the biodiffusion zone and $m_{ft}$ is the tube bottom zone. Arrows from B to A point to sediment surface, the bottom of aOLD at 1.7 cm considered the bottom of the resuspension zone, and the level of the deepest observed infauna at 15.1 cm. B and C are modified from Swift et al. (1996) and D from François et al. (2002). Scale along side of image is in cm.

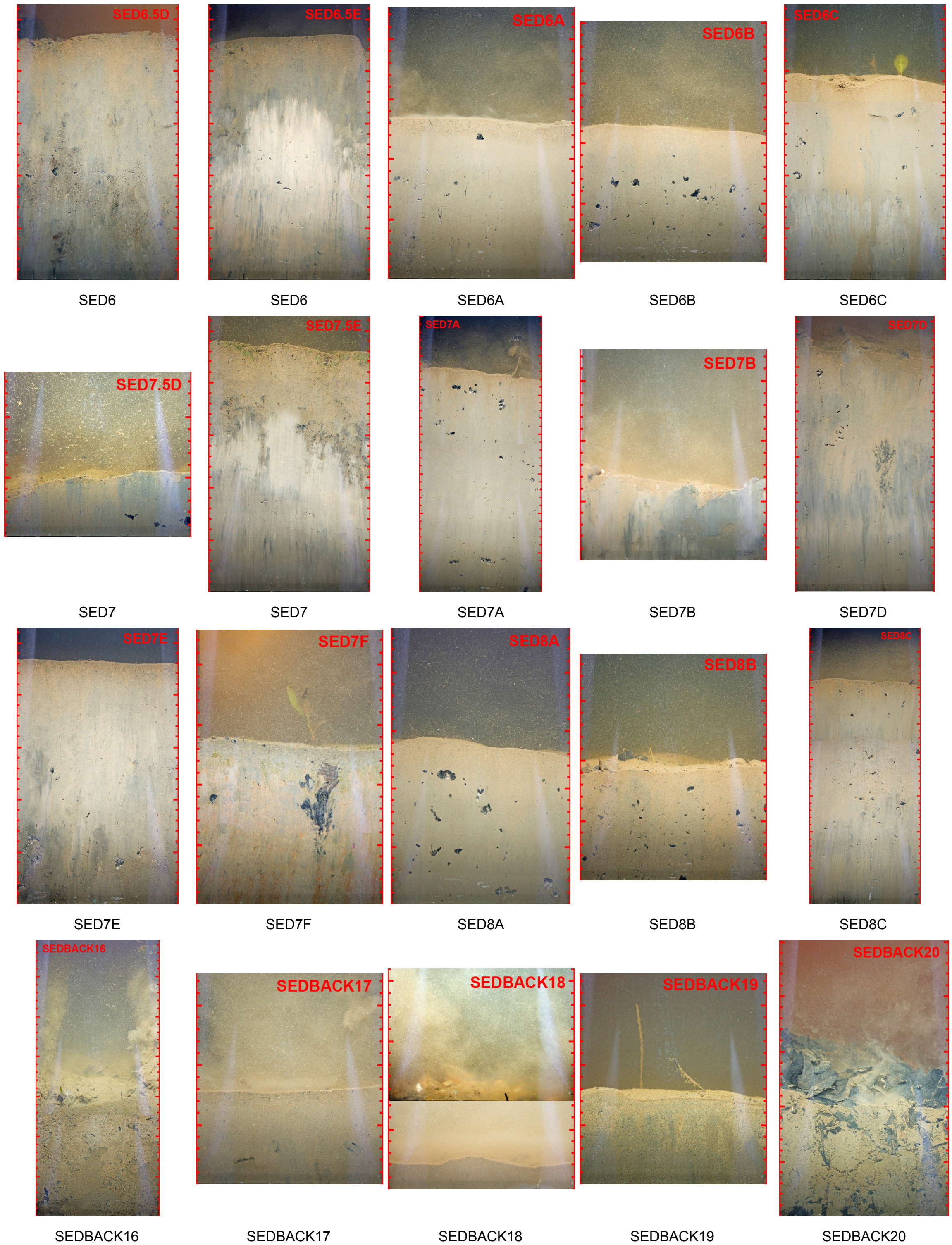


Figure 4. Sediment Profile Images from Pepco–Benning Road Facility, Washington, DC, May 2017. Two replicate images are combined for SEDBACK18. Scale on side of image is in cm.

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# Attachment D

# List of Species Observed and Presence of Listed or Sensitive Species

**Attachment D Table 1**
**Species Observed in the Vicinity of the Site**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Aquatic and Terrestrial Plants (a) |
|---|
| Algea |
| Common reed (Phragmites australis) |
| Cattail (Typha sp.) |
| Maple trees (Acer sp.) |
| Oak trees (Quercus sp.) |

| Benthic Invertebrates (a) |
|---|
| Oligochaete |
| Midge |
| Mollusks |
| Crustacean |
| Leech |

| Birds (c, d) |
|---|
| Eastern kingbird (Tyrannus tyrannus), |
| Warbling vireos (Vireo gilvus) |
| Orchard Orioles (Icterus spurius) |
| Baltimore Orioles (Icterus galbula |
| Great blue heron (Ardea herodias) |
| Canada geese (Branta Canadensis) |
| Mallards (Anas platyrhynchos) |
| Ring-billed gull (Larus delawarensis) |
| Herring gull (Larus argentatus) |
| Great black-backed (Larus marinus) |
| Laughing gull (Leucophaeus atricilla) |
| Forster's tern (Sterna forsteri) |
| American coot (Fulica Americana) |
| Double-crested cormorants (Phalacrocorax auritus) |
| Bufflehead duck (Phalacrocorax auritus) |
| Hooded merganser (Lophodytes cucullatus) |
| Ruddy duck (Oxyura jamaicensis) |
| Bald eagle (Haliaeetus leucocephalus) |
| Great egret (Ardea alba) |

| Fish (a, b) |
|---|
| White perch (Morone americana) |
| Striped bass (Morone saxatilis) |
| Blueback herring (Alosa aestivalis) |
| Alewife herring (A. pseudoharengus) |
| American and hickory shad (Dorosoma spp.) |
| American eel (Anguilla rostrata) |
| Pumpkinseed (L. gibbosus) |
| Carp (Cyprinus carpio) |
| Channel catfish (Ictalarus punctatus |
| Blue catfish (Ictalarus furcatus |
| Brown bullhead (Ameiurus nebulosus |
| Smallmouth bass (Micropterus dolomieu) |
| Largemouth bass (Micropterus salmoides) |
| Yellow perch (Perca flavescens) |

| Mammals (c) |
|---|
| Eastern mole (Scalopus aquaticus) |
| White-tailed deer (Odocoileus virginianus) |
| Raccoon (Procyon lotor) |
| White-footed mouse (Peromyscus leucopus) |
| Muskrat (Ondatra zibethica) |
| Beaver (Castor canadensis) |
| Eastern gray squirrel (Sciurus carolinensis) |
| Big brown bat (Eptesicus fuscus) |
| Red bat (Lasiurus borealis) |

Notes:
(a) United States Fish and Wildlife Service (USFWS) surveys.
(b) AWTA, 2002. Charting a Course Toward Restoration: A Toxic Chemical Management Strategy for the Anacostia River.
(c) United States Geological Service (USGS) Patuxent Wildlife Research Center
Available for birds (http://www.mbr-pwrc.usgs.gov/infocenter/Nps/anacintro.htm), and mammals (http://www.pwrc.usgs.gov/blitz/mambio.html).
(d) Oberservations of birds present on the mudflats by AECOM on December 17, 2014.
(e) AECOM consulted with the DOEE, USFWS Chesapeake Bay Field Office, and NOAA NMFS to determine if any or federally listed species or other sensitive receptors exist at or in the vicinity of the Waterside Investigation Area. Agency responses were recieved in January 2015. Responses indicated no federally listed or proposed threatened or endangered species under NOAA NMFS jurisdiction are present; and DOEE responded that no listed or sensitive species communities are present.

pepco
An Exelon Company

# Attachment E

# Sediment Toxicity Test Reports

**September 15, 2017**

Mr. Robert Kennedy
Ecological Risk Assessment, Environmental
AECOM
250 Apollo Drive
Chelmsford, NH 01824

**Re: Report on sediment toxicity tests (Pepco Benning RI/FS Project), AECOM Project # 60340344, AECOM P.O. # 90384.**

Dear Mr. Kennedy:

Attached please find the electronic copy (PDF) of the report and data package on the results of sediment toxicity tests completed on samples associated with the Pepco Benning RI/FS Project. The report for the *Chironomus dilutus* 10-day survival and growth tests (EPA Method 100.2) is attached. Statistical comparisons of survival and growth (dry weight) data to the Control sediment (our sample # 50413) and the reference/background sediments (five of them) have been completed.

Please do not hesitate to contact me if you have any questions and thank you for the opportunity to work with you on this project.

Sincerely,

John Williams

John W. Williams
Director

**This report consists of the following numbered pages:** SDG 15151 – 130pgs

**Aquatec Environmental, Inc.**
273 Commerce Street • Williston, Vermont 05495 • 802-860-2960 • jwilliams@aquatecenv.com

# Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

AECOM
250 Apollo Drive

Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com

**Project:** Pepco Benning Road Facility

## TOXICITY SUMMARY REPORT:

### 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

| Sample Identification | | Control Group | Mean Percent Surviving (%) | | Mean Ash-free Weight (mg) | |
|---|---|---|---|---|---|---|
| 50413 | CONTROL | A | 91.3% | | 1.888 | |
| 50415 | SED6C00EN | A | 91.3% | | 1.738 | **b,d,f** |
| 50416 | SED8C00EN | A | 85.0% | | 1.731 | **b,d,f** |
| 50417 | SED7B00EN | A | 88.8% | | 1.409 | **a,b,c,d,e,f** |
| 50418 | SED7F00EN | A | 87.5% | | 1.865 | **b,f** |
| 50419 | SED7.5E00EN | A | 92.5% | | 1.637 | **a,b,c,d,e,f** |
| 50420 | SED6.5E00EN | A | 90.0% | | 1.897 | **b,f** |
| 50421 | SED7E00EN | A | 93.8% | | 1.786 | **b,d,f** |
| 50422 | SED6B00EN | A | 92.5% | | 1.839 | **b,f** |
| 50423 | SED6A00EN | A | 87.5% | | 1.934 | **b** |
| 50424 | SED7.5D00EN | A | 87.5% | | 1.722 | **b,d,f** |
| 50425 | SED7D00EN | A | 88.8% | | 1.876 | **b,f** |
| 50426 | SED6.5D00EN | A | 82.5% | **a** | 1.787 | **b,d,f** |
| 50427 | SED8A00EN | A | 85.0% | | 1.956 | **b** |
| 50428 | SED7A00EN | A | 87.5% | | 1.874 | **b,f** |
| 50429 | SED8B00EN | A | 88.8% | | 1.880 | **b,f** |
| 50430 | SEDBACK1600N | A | 83.8% | **a** | 2.370 | |
| 50431 | SEDBACK1700N | A | 90.0% | | 1.802 | |
| 50432 | SEDBACK1800N | A | 86.3% | | 2.050 | |
| 50433 | SEDBACK1900N | A | 90.0% | | 1.918 | |
| 50434 | SEDBACK2000N | A | 85.0% | | 2.088 | |

a) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the laboratory control (50413 - Control).
b) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50430 - SEDBACK1600N).
c) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50431 - SEDBACK1700N).
d) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50432 - SEDBACK1800N).
e) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50433 - SEDBACK1900N).
f) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference control (50434 - SEDBACK2000N).

## SAMPLES RECEIVED:

| Number | Sample Name | Date Time and Collected | Type |
|---|---|---|---|
| 50413 | CONTROL | | Control Sediment |
| 50415 | SED6C00EN | 6/7/2017 10:00:00 AM | Sediment |
| 50416 | SED8C00EN | 6/7/2017 11:30:00 AM | Sediment |
| 50417 | SED7B00EN | 6/7/2017 12:30:00 PM | Sediment |
| 50418 | SED7F00EN | 6/8/2017 8:30:00 AM | Sediment |
| 50419 | SED7.5E00EN | 6/8/2017 9:15:00 AM | Sediment |
| 50420 | SED6.5E00EN | 6/8/2017 10:00:00 AM | Sediment |
| 50421 | SED7E00EN | 6/8/2017 10:30:00 AM | Sediment |
| 50422 | SED6B00EN | 6/8/2017 12:30:00 PM | Sediment |
| 50423 | SED6A00EN | 6/8/2017 1:15:00 PM | Sediment |
| 50424 | SED7.5D00EN | 6/9/2017 8:15:00 AM | Sediment |
| 50425 | SED7D00EN | 6/9/2017 9:15:00 AM | Sediment |
| 50426 | SED6.5D00EN | 6/9/2017 9:45:00 AM | Sediment |
| 50427 | SED8A00EN | 6/9/2017 10:30:00 AM | Sediment |
| 50428 | SED7A00EN | 6/9/2017 11:15:00 AM | Sediment |
| 50429 | SED8B00EN | 6/9/2017 12:00:00 PM | Sediment |
| 50430 | SEDBACK1600N | 6/12/2017 10:15:00 AM | Sediment |
| 50431 | SEDBACK1700N | 6/12/2017 12:00:00 PM | Sediment |
| 50432 | SEDBACK1800N | 6/12/2017 1:15:00 PM | Sediment |
| 50433 | SEDBACK1900N | 6/13/2017 8:00:00 AM | Sediment |
| 50434 | SEDBACK2000N | 6/13/2017 9:45:00 AM | Sediment |

Submitted By:

# Aquatec Environmental, Inc.

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250 Apollo Drive

Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com

**Project:** Pepco Benning Road Facility

## TOXICITY DETAIL REPORT:

### 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

Sample ID: 50413 CONTROL

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 8 | 2239.59 | 2261.79 | 2247.24 | ***1.82*** |
| B | 10 | 9 | ***90.0%*** | 6 | 2120.82 | 2134.15 | 2123.55 | ***1.77*** |
| C | 10 | 9 | ***90.0%*** | 7 | 2386.59 | 2406.66 | 2393.44 | ***1.89*** |
| D | 10 | 9 | ***90.0%*** | 9 | 2287.33 | 2309.32 | 2294.38 | ***1.66*** |
| E | 10 | 9 | ***90.0%*** | 7 | 2313.89 | 2331.58 | 2319.24 | ***1.76*** |
| F | 10 | 10 | ***100.0%*** | 9 | 2130.40 | 2153.35 | 2137.94 | ***1.71*** |
| G | 10 | 9 | ***90.0%*** | 4 | 2181.44 | 2193.04 | 2185.09 | ***1.99*** |
| H | 10 | 9 | ***90.0%*** | 4 | 2491.51 | 2503.68 | 2493.66 | ***2.51*** |

Mean Percent Surviving: 91.3% Mean Ash-free Growth (mg): 1.89

Sample ID: 50415 SED6C00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 7 | 2283.37 | 2299.25 | 2286.92 | ***1.76*** |
| B | 10 | 9 | ***90.0%*** | 8 | 2321.45 | 2339.95 | 2325.75 | ***1.77*** |
| C | 10 | 10 | ***100.0%*** | 6 | 2282.69 | 2295.30 | 2284.82 | ***1.75*** |
| D | 10 | 8 | ***80.0%*** | 7 | 2389.87 | 2405.82 | 2393.04 | ***1.83*** |
| E | 10 | 7 | ***70.0%*** | 5 | 2485.21 | 2498.95 | 2488.51 | ***2.09*** |
| F | 10 | 10 | ***100.0%*** | 6 | 2263.68 | 2278.14 | 2268.15 | ***1.66*** |
| G | 10 | 10 | ***100.0%*** | 7 | 2385.69 | 2397.55 | 2387.89 | ***1.38*** |
| H | 10 | 10 | ***100.0%*** | 8 | 2426.55 | 2444.03 | 2430.72 | ***1.66*** |

Mean Percent Surviving: 91.3% Mean Ash-free Growth (mg): 1.74

## TOXICITY DETAIL REPORT:

### 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

Sample ID: 50416 SED8C00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 8 | ***80.0%*** | 7 | 2445.19 | 2462.55 | 2449.10 | ***1.92*** |
| B | 10 | 10 | ***100.0%*** | 10 | 2302.44 | 2324.27 | 2307.53 | ***1.67*** |
| C | 10 | 9 | ***90.0%*** | 9 | 2377.87 | 2399.91 | 2384.98 | ***1.66*** |
| D | 10 | 9 | ***90.0%*** | 9 | 2380.75 | 2398.18 | 2384.28 | ***1.54*** |
| E | 10 | 8 | ***80.0%*** | 7 | 2218.17 | 2231.44 | 2220.49 | ***1.56*** |
| F | 10 | 9 | ***90.0%*** | 7 | 2422.21 | 2437.69 | 2425.83 | ***1.69*** |
| G | 10 | 7 | ***70.0%*** | 7 | 2306.94 | 2322.69 | 2309.34 | ***1.91*** |
| H | 10 | 8 | ***80.0%*** | 6 | 2302.09 | 2316.59 | 2305.31 | ***1.88*** |

Mean Percent Surviving: 85.0% Mean Ash-free Growth (mg): 1.73

Sample ID: 50417 SED7B00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 8 | ***80.0%*** | 8 | 2163.20 | 2178.96 | 2166.89 | ***1.51*** |
| B | 10 | 9 | ***90.0%*** | 8 | 2148.70 | 2164.70 | 2152.70 | ***1.50*** |
| C | 10 | 9 | ***90.0%*** | 7 | 2103.43 | 2115.26 | 2106.43 | ***1.26*** |
| D | 10 | 8 | ***80.0%*** | 6 | 2187.25 | 2199.69 | 2189.42 | ***1.71*** |
| E | 10 | 10 | ***100.0%*** | 10 | 2248.11 | 2266.87 | 2253.57 | ***1.33*** |
| F | 10 | 10 | ***100.0%*** | 9 | 2139.13 | 2153.90 | 2143.50 | ***1.16*** |
| G | 10 | 9 | ***90.0%*** | 9 | 2030.84 | 2047.12 | 2034.85 | ***1.36*** |
| H | 10 | 8 | ***80.0%*** | 7 | 2167.34 | 2179.02 | 2168.94 | ***1.44*** |

Mean Percent Surviving: 88.8% Mean Ash-free Growth (mg): 1.41

Sample ID: 50418 SED7F00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 8 | ***80.0%*** | 6 | 2157.91 | 2172.05 | 2160.19 | ***1.98*** |
| B | 10 | 8 | ***80.0%*** | 7 | 2182.67 | 2198.71 | 2185.35 | ***1.91*** |
| C | 10 | 9 | ***90.0%*** | 9 | 2058.36 | 2078.14 | 2061.64 | ***1.83*** |
| D | 10 | 9 | ***90.0%*** | 6 | 2195.10 | 2208.00 | 2197.59 | ***1.73*** |
| E | 10 | 9 | ***90.0%*** | 8 | 2111.52 | 2128.59 | 2115.46 | ***1.64*** |
| F | 10 | 10 | ***100.0%*** | 8 | 2194.36 | 2211.14 | 2197.63 | ***1.69*** |
| G | 10 | 9 | ***90.0%*** | 9 | 2204.65 | 2226.28 | 2208.70 | ***1.95*** |
| H | 10 | 8 | ***80.0%*** | 5 | 2219.37 | 2232.01 | 2221.08 | ***2.19*** |

Mean Percent Surviving: 87.5% Mean Ash-free Growth (mg): 1.87

## TOXICITY DETAIL REPORT:

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

### Sample ID: 50419 SED7.5E00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 2116.70 | 2137.60 | 2122.86 | ***1.47*** |
| B | 10 | 10 | ***100.0%*** | 10 | 2053.25 | 2075.08 | 2058.74 | ***1.63*** |
| C | 10 | 9 | ***90.0%*** | 9 | 2184.03 | 2203.29 | 2187.15 | ***1.79*** |
| D | 10 | 8 | ***80.0%*** | 7 | 2138.64 | 2156.50 | 2143.12 | ***1.91*** |
| E | 10 | 10 | ***100.0%*** | 10 | 2204.97 | 2220.40 | 2207.35 | ***1.30*** |
| F | 10 | 9 | ***90.0%*** | 8 | 2190.21 | 2207.66 | 2193.91 | ***1.72*** |
| G | 10 | 10 | ***100.0%*** | 8 | 2181.66 | 2197.41 | 2185.23 | ***1.52*** |
| H | 10 | 8 | ***80.0%*** | 6 | 2223.00 | 2235.22 | 2224.79 | ***1.74*** |

Mean Percent Surviving: 92.5% Mean Ash-free Growth (mg): 1.64

### Sample ID: 50420 SED6.5E00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 2175.49 | 2198.79 | 2180.89 | ***1.79*** |
| B | 10 | 8 | ***80.0%*** | 6 | 2208.29 | 2222.76 | 2211.32 | ***1.91*** |
| C | 10 | 9 | ***90.0%*** | 7 | 2165.83 | 2180.75 | 2167.60 | ***1.88*** |
| D | 10 | 7 | ***70.0%*** | 6 | 2456.20 | 2474.78 | 2459.82 | ***2.49*** |
| E | 10 | 10 | ***100.0%*** | 7 | 2142.99 | 2157.79 | 2146.15 | ***1.66*** |
| F | 10 | 10 | ***100.0%*** | 8 | 2105.90 | 2124.40 | 2111.22 | ***1.65*** |
| G | 10 | 8 | ***80.0%*** | 7 | 2111.16 | 2127.79 | 2114.35 | ***1.92*** |
| H | 10 | 10 | ***100.0%*** | 9 | 2112.06 | 2134.34 | 2117.45 | ***1.88*** |

Mean Percent Surviving: 90.0% Mean Ash-free Growth (mg): 1.90

### Sample ID: 50421 SED7E00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 8 | 2018.96 | 2039.98 | 2024.45 | ***1.94*** |
| B | 10 | 10 | ***100.0%*** | 9 | 2224.39 | 2243.29 | 2228.16 | ***1.68*** |
| C | 10 | 8 | ***80.0%*** | 7 | 2173.63 | 2191.22 | 2178.52 | ***1.81*** |
| D | 10 | 10 | ***100.0%*** | 8 | 2111.23 | 2128.78 | 2114.79 | ***1.75*** |
| E | 10 | 9 | ***90.0%*** | 7 | 2125.34 | 2140.17 | 2128.31 | ***1.69*** |
| F | 10 | 10 | ***100.0%*** | 9 | 2100.09 | 2120.11 | 2103.95 | ***1.80*** |
| G | 10 | 10 | ***100.0%*** | 8 | 2180.71 | 2199.80 | 2185.26 | ***1.82*** |
| H | 10 | 8 | ***80.0%*** | 8 | 2201.19 | 2219.81 | 2205.45 | ***1.80*** |

Mean Percent Surviving: 93.8% Mean Ash-free Growth (mg): 1.79

# TOXICITY DETAIL REPORT:

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

### Sample ID: 50422 SED6B00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 9 | 2140.55 | 2161.55 | 2145.53 | ***1.78*** |
| B | 10 | 8 | ***80.0%*** | 7 | 2281.97 | 2297.93 | 2285.49 | ***1.78*** |
| C | 10 | 8 | ***80.0%*** | 7 | 2063.26 | 2083.43 | 2069.21 | ***2.03*** |
| D | 10 | 10 | ***100.0%*** | 7 | 2021.08 | 2035.97 | 2024.78 | ***1.60*** |
| E | 10 | 9 | ***90.0%*** | 6 | 2193.39 | 2208.11 | 2196.89 | ***1.87*** |
| F | 10 | 10 | ***100.0%*** | 7 | 2196.48 | 2214.72 | 2200.73 | ***2.00*** |
| G | 10 | 10 | ***100.0%*** | 8 | 2145.05 | 2162.86 | 2149.53 | ***1.67*** |
| H | 10 | 9 | ***90.0%*** | 6 | 2306.45 | 2321.46 | 2309.51 | ***1.99*** |

Mean Percent Surviving: 92.5% Mean Ash-free Growth (mg): 1.84

### Sample ID: 50423 SED6A00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 7 | ***70.0%*** | 4 | 2533.80 | 2544.52 | 2535.91 | ***2.15*** |
| B | 10 | 7 | ***70.0%*** | 6 | 2202.60 | 2219.01 | 2205.81 | ***2.20*** |
| C | 10 | 9 | ***90.0%*** | 8 | 2187.84 | 2204.08 | 2190.81 | ***1.66*** |
| D | 10 | 9 | ***90.0%*** | 9 | 2242.08 | 2259.73 | 2246.28 | ***1.49*** |
| E | 10 | 10 | ***100.0%*** | 10 | 2046.35 | 2066.62 | 2050.05 | ***1.66*** |
| F | 10 | 9 | ***90.0%*** | 9 | 2119.54 | 2143.49 | 2125.50 | ***2.00*** |
| G | 10 | 10 | ***100.0%*** | 7 | 2188.67 | 2207.57 | 2195.30 | ***1.75*** |
| H | 10 | 9 | ***90.0%*** | 3 | 2119.68 | 2129.45 | 2121.78 | ***2.56*** |

Mean Percent Surviving: 87.5% Mean Ash-free Growth (mg): 1.93

### Sample ID: 50424 SED7.5D00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 7 | 2174.34 | 2190.71 | 2178.87 | ***1.69*** |
| B | 10 | 8 | ***80.0%*** | 7 | 2159.00 | 2174.42 | 2161.76 | ***1.81*** |
| C | 10 | 10 | ***100.0%*** | 9 | 2092.16 | 2108.99 | 2096.47 | ***1.39*** |
| D | 10 | 9 | ***90.0%*** | 7 | 2434.71 | 2449.83 | 2438.53 | ***1.61*** |
| E | 10 | 7 | ***70.0%*** | 5 | 2255.21 | 2267.91 | 2258.05 | ***1.97*** |
| F | 10 | 9 | ***90.0%*** | 6 | 2068.78 | 2081.98 | 2071.02 | ***1.83*** |
| G | 10 | 8 | ***80.0%*** | 7 | 2245.47 | 2261.58 | 2248.59 | ***1.86*** |
| H | 10 | 10 | ***100.0%*** | 10 | 2208.05 | 2228.99 | 2212.83 | ***1.62*** |

Mean Percent Surviving: 87.5% Mean Ash-free Growth (mg): 1.72

## TOXICITY DETAIL REPORT:

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

Sample ID: 50425 SED7D00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 7 | 2101.40 | 2119.13 | 2106.53 | ***1.80*** |
| B | 10 | 10 | ***100.0%*** | 7 | 2221.89 | 2240.25 | 2227.55 | ***1.81*** |
| C | 10 | 9 | ***90.0%*** | 7 | 2195.78 | 2214.27 | 2202.56 | ***1.67*** |
| D | 10 | 8 | ***80.0%*** | 6 | 2120.94 | 2139.09 | 2126.93 | ***2.03*** |
| E | 10 | 9 | ***90.0%*** | 8 | 2292.15 | 2309.43 | 2295.66 | ***1.72*** |
| F | 10 | 9 | ***90.0%*** | 7 | 2211.01 | 2227.23 | 2215.05 | ***1.74*** |
| G | 10 | 7 | ***70.0%*** | 2 | 2158.28 | 2164.29 | 2159.13 | ***2.58*** |
| H | 10 | 10 | ***100.0%*** | 8 | 2145.21 | 2163.20 | 2149.99 | ***1.65*** |

Mean Percent Surviving: 88.8% Mean Ash-free Growth (mg): 1.88

Sample ID: 50426 SED6.5D00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 8 | 2210.23 | 2226.31 | 2213.52 | ***1.60*** |
| B | 10 | 7 | ***70.0%*** | 7 | 2333.21 | 2354.81 | 2340.68 | ***2.02*** |
| C | 10 | 9 | ***90.0%*** | 8 | 2213.80 | 2231.22 | 2218.04 | ***1.65*** |
| D | 10 | 8 | ***80.0%*** | 6 | 2429.67 | 2444.87 | 2433.46 | ***1.90*** |
| E | 10 | 7 | ***70.0%*** | 5 | 2376.13 | 2390.31 | 2379.17 | ***2.23*** |
| F | 10 | 7 | ***70.0%*** | 6 | 2345.83 | 2362.15 | 2350.34 | ***1.97*** |
| G | 10 | 10 | ***100.0%*** | 9 | 2328.45 | 2343.96 | 2331.77 | ***1.35*** |
| H | 10 | 9 | ***90.0%*** | 7 | 2391.76 | 2407.34 | 2396.27 | ***1.58*** |

Mean Percent Surviving: 82.5% Mean Ash-free Growth (mg): 1.79

Sample ID: 50427 SED8A00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 8 | ***80.0%*** | 4 | 2462.99 | 2476.02 | 2467.02 | ***2.25*** |
| B | 10 | 6 | ***60.0%*** | 4 | 2354.57 | 2366.13 | 2356.99 | ***2.28*** |
| C | 10 | 8 | ***80.0%*** | 7 | 2409.63 | 2428.50 | 2413.79 | ***2.10*** |
| D | 10 | 9 | ***90.0%*** | 6 | 2357.68 | 2373.14 | 2360.36 | ***2.13*** |
| E | 10 | 10 | ***100.0%*** | 10 | 2322.37 | 2343.17 | 2325.07 | ***1.81*** |
| F | 10 | 10 | ***100.0%*** | 8 | 2256.12 | 2273.99 | 2261.18 | ***1.60*** |
| G | 10 | 7 | ***70.0%*** | 5 | 2353.67 | 2364.60 | 2355.23 | ***1.87*** |
| H | 10 | 10 | ***100.0%*** | 8 | 2206.96 | 2223.49 | 2210.73 | ***1.60*** |

Mean Percent Surviving: 85.0% Mean Ash-free Growth (mg): 1.96

## TOXICITY DETAIL REPORT:

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

### Sample ID: 50428 SED7A00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 8 | 2374.84 | 2391.69 | 2377.49 | ***1.77*** |
| B | 10 | 8 | ***80.0%*** | 6 | 2139.07 | 2155.16 | 2142.61 | ***2.09*** |
| C | 10 | 10 | ***100.0%*** | 9 | 2164.81 | 2183.72 | 2168.43 | ***1.70*** |
| D | 10 | 8 | ***80.0%*** | 6 | 2262.71 | 2274.73 | 2264.08 | ***1.77*** |
| E | 10 | 8 | ***80.0%*** | 5 | 2481.27 | 2493.86 | 2484.17 | ***1.94*** |
| F | 10 | 8 | ***80.0%*** | 8 | 2330.40 | 2350.13 | 2334.55 | ***1.95*** |
| G | 10 | 8 | ***80.0%*** | 7 | 2320.90 | 2337.99 | 2323.78 | ***2.03*** |
| H | 10 | 10 | ***100.0%*** | 10 | 2168.30 | 2189.29 | 2171.95 | ***1.73*** |

Mean Percent Surviving: 87.5% Mean Ash-free Growth (mg): 1.87

### Sample ID: 50429 SED8B00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 8 | 2259.73 | 2281.62 | 2266.05 | ***1.95*** |
| B | 10 | 9 | ***90.0%*** | 7 | 2424.95 | 2443.35 | 2429.48 | ***1.98*** |
| C | 10 | 8 | ***80.0%*** | 6 | 2226.23 | 2242.71 | 2230.96 | ***1.96*** |
| D | 10 | 10 | ***100.0%*** | 10 | 2224.61 | 2247.50 | 2229.58 | ***1.79*** |
| E | 10 | 10 | ***100.0%*** | 9 | 2371.43 | 2390.01 | 2374.08 | ***1.77*** |
| F | 10 | 7 | ***70.0%*** | 5 | 2349.43 | 2362.13 | 2353.08 | ***1.81*** |
| G | 10 | 8 | ***80.0%*** | 5 | 2402.17 | 2413.47 | 2404.32 | ***1.83*** |
| H | 10 | 10 | ***100.0%*** | 8 | 2287.93 | 2306.54 | 2290.94 | ***1.95*** |

Mean Percent Surviving: 88.8% Mean Ash-free Growth (mg): 1.88

### Sample ID: 50430 SEDBACK1600N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 8 | ***80.0%*** | 5 | 2398.13 | 2415.69 | 2400.62 | ***3.01*** |
| B | 10 | 8 | ***80.0%*** | 6 | 2434.86 | 2451.81 | 2437.21 | ***2.43*** |
| C | 10 | 7 | ***70.0%*** | 6 | 2327.95 | 2344.06 | 2330.84 | ***2.20*** |
| D | 10 | 9 | ***90.0%*** | 8 | 2243.07 | 2262.81 | 2246.15 | ***2.08*** |
| E | 10 | 7 | ***70.0%*** | 5 | 2243.43 | 2257.26 | 2244.85 | ***2.48*** |
| F | 10 | 9 | ***90.0%*** | 8 | 2337.33 | 2358.25 | 2341.15 | ***2.14*** |
| G | 10 | 10 | ***100.0%*** | 8 | 2283.65 | 2306.21 | 2286.87 | ***2.42*** |
| H | 10 | 9 | ***90.0%*** | 7 | 2385.81 | 2404.22 | 2388.88 | ***2.19*** |

Mean Percent Surviving: 83.8% Mean Ash-free Growth (mg): 2.37

# TOXICITY DETAIL REPORT:

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

### Sample ID: 50431 SEDBACK1700N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 8 | ***80.0%*** | 5 | 2266.97 | 2277.76 | 2268.90 | ***1.77*** |
| B | 10 | 9 | ***90.0%*** | 6 | 2299.66 | 2312.07 | 2302.40 | ***1.61*** |
| C | 10 | 10 | ***100.0%*** | 7 | 2376.12 | 2391.41 | 2378.81 | ***1.80*** |
| D | 10 | 9 | ***90.0%*** | 9 | 2255.85 | 2276.07 | 2261.25 | ***1.65*** |
| E | 10 | 9 | ***90.0%*** | 8 | 2261.49 | 2281.55 | 2266.02 | ***1.94*** |
| F | 10 | 9 | ***90.0%*** | 8 | 2192.91 | 2210.04 | 2196.37 | ***1.71*** |
| G | 10 | 10 | ***100.0%*** | 10 | 2366.09 | 2391.89 | 2372.46 | ***1.94*** |
| H | 10 | 8 | ***80.0%*** | 5 | 2177.66 | 2189.89 | 2179.92 | ***1.99*** |

Mean Percent Surviving: 90.0% Mean Ash-free Growth (mg): 1.80

### Sample ID: 50432 SEDBACK1800N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 8 | 2225.23 | 2245.18 | 2229.04 | ***2.02*** |
| B | 10 | 9 | ***90.0%*** | 8 | 2418.85 | 2439.27 | 2422.97 | ***2.04*** |
| C | 10 | 10 | ***100.0%*** | 8 | 2278.78 | 2293.81 | 2281.66 | ***1.52*** |
| D | 10 | 8 | ***80.0%*** | 5 | 2405.27 | 2418.58 | 2408.08 | ***2.10*** |
| E | 10 | 8 | ***80.0%*** | 6 | 2274.42 | 2292.05 | 2277.99 | ***2.34*** |
| F | 10 | 10 | ***100.0%*** | 8 | 2353.14 | 2370.38 | 2356.47 | ***1.74*** |
| G | 10 | 7 | ***70.0%*** | 4 | 2345.72 | 2357.78 | 2348.04 | ***2.43*** |
| H | 10 | 8 | ***80.0%*** | 5 | 2432.92 | 2446.10 | 2435.04 | ***2.21*** |

Mean Percent Surviving: 86.3% Mean Ash-free Growth (mg): 2.05

### Sample ID: 50433 SEDBACK1900N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 11 | 11 | ***100.0%*** | 9 | 2337.31 | 2359.92 | 2342.43 | ***1.94*** |
| B | 11 | 11 | ***100.0%*** | 8 | 2300.24 | 2313.94 | 2302.56 | ***1.42*** |
| C | 10 | 10 | ***100.0%*** | 8 | 2332.18 | 2350.41 | 2336.94 | ***1.68*** |
| D | 10 | 10 | ***100.0%*** | 9 | 2283.81 | 2307.90 | 2290.11 | ***1.98*** |
| E | 10 | 9 | ***90.0%*** | 9 | 2443.42 | 2465.03 | 2449.19 | ***1.76*** |
| F | 10 | 9 | ***90.0%*** | 8 | 2366.56 | 2385.83 | 2372.71 | ***1.64*** |
| G | 10 | 8 | ***80.0%*** | 4 | 2226.11 | 2238.99 | 2229.54 | ***2.36*** |
| H | 10 | 6 | ***60.0%*** | 5 | 2279.53 | 2295.71 | 2282.95 | ***2.55*** |

Mean Percent Surviving: 90.0% Mean Ash-free Growth (mg): 1.92

# TOXICITY DETAIL REPORT:

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

***Test Start:*** *8/1/2017 7:30:00 PM* ***Test End:*** *8/11/2017 4:45:00 PM*

Sample ID: 50434 SEDBACK2000N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial Crucible (mg) | Final Crucible (mg) | Ashed Crucible (mg) | Mean Ash-Free Weight (mg) |
|---|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 8 | 2206.93 | 2226.64 | 2210.34 | ***2.04*** |
| B | 10 | 9 | ***90.0%*** | 8 | 2236.75 | 2255.22 | 2240.17 | ***1.88*** |
| C | 10 | 9 | ***90.0%*** | 6 | 2403.79 | 2419.68 | 2407.59 | ***2.01*** |
| D | 10 | 7 | ***70.0%*** | 3 | 2397.78 | 2407.67 | 2399.66 | ***2.67*** |
| E | 10 | 9 | ***90.0%*** | 8 | 2494.64 | 2517.56 | 2500.62 | ***2.12*** |
| F | 10 | 9 | ***90.0%*** | 7 | 2282.77 | 2299.13 | 2286.26 | ***1.84*** |
| G | 10 | 10 | ***100.0%*** | 9 | 2426.65 | 2447.80 | 2430.66 | ***1.90*** |
| H | 10 | 6 | ***60.0%*** | 6 | 2216.36 | 2234.17 | 2220.74 | ***2.24*** |

Mean Percent Surviving: 85.0% Mean Ash-free Growth (mg): 2.09

Submitted By:

# Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960



AECOM
250 Apollo Drive

Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com


**Project:** Pepco Benning Road Facility

## Narrative

Twenty project sediment samples in 1-gal HDPE buckets were delivered to Aquatec Environmental, Inc. (Aquatec) on June 15, 2017. All samples were in coolers, with samples well iced and temperature blanks measured between 1.2C and 1.4C. Samples were logged in for "Hold" pending approval to proceed with testing. Each sample was assigned a unique sample number and transferred to refrigerated storage.

On July 20, 2017 AECOM communicated that twenty of the samples would be tested and provided authorization to proceed. The selected samples were logged in for EPA Method 100.1 (Hyalella azteca 10-day survival and growth) and EPA Method 100.2 (Chironomus dilutus 10-day survival and growth).

Control sediment was a mix of natural sediment collected from the Lamoille River, Vermont and Lake Arrowhead, Vermont on June 19, 2017. Control sediment was sieved through a 0.5mm SS mesh sieve in the field at the time of collection.

Un-sieved sediment for each sample was loaded into test beakers on July 27, 2017 for the Hyalella azteca 10-day test and on July 31, 2017 for the Chironomus dilutus 10-day test. Overlying water was introduced following distribution of sediments to beakers and replicates were distributed to temperature-controlled water baths with automated overlying water renewals programmed at 12h intervals.

Statistical analysis of survival and growth was based on paired t-test comparisons to the corresponding response in the control (sample 50413) and to the five reference samples identified by AECOM: Aquatec sample numbers 50430 (SEDBACK1600N), 50431 (SEDBACK1700N), 50432 (SEDBACK1800N), 50433 (SEDBACK1900N), and 50434 (SEDBACK2000N).

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**Project:** Pepco Benning Road Facility

## 100.2 - Midge, C. dilutus, 10-D Survival and Growth Qualifiers

The Chironomus dilutus 10-day tests were started on August 1, 2017 when ten 2nd/3rd-instar larvae (eight days old) were transferred to each replicate. After larvae were added, each replicate was examined to determine whether larvae had settled to the sediment or were floating on the water surface. If floaters were observed, they were either re-submerged with a drop of water or removed and replaced.

Aeration was provided to all replicates of all samples on August 3 (Day 2) when a declining dissolved oxygen concentration was observed in Sample 50422 (SED6B00EN). Aeration was continued throughout the remainder of the test to all replicates of all samples.

On August 9 (Day 8) emergence traps were placed over each replicate to capture any early emerging flies. On Day 10 when tests were ended, some replicates had emerged flies and pupae. Surviving larvae were cleaned and transferred to pre-weighed crucibles for the ash-free dry weight analysis. Pupae or emerged flies were included in the survival total but were not included in the growth analysis. The Control replicates had an average of 91.3% survival and the mean ash-free dry weight was 1.89 mg, therefore control acceptability criteria were met.

When larvae were cleaned for transfer to crucibles there was an opportunity to reassess larval and pupal stages. Some larvae may have pupated while stored in 1oz cups with water prior to cleaning and transfer to crucibles. Any additional larvae that had transformed to pupae prior to cleaning were excluded from the dry weight analysis resulting in some replicates with the number weighed being one or two less than the original number of larvae recorded.

Replicates A and B of Sample 50433 (SEDBACK1900N) had eleven larvae recovered. Apparently one extra larvae were distributed to these replicates when the tests were started. Data were tabulated as recorded on the bench sheets for these replicates.

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**Project:** Pepco Benning Road Facility

## REPORT CERTIFICATION:

*The results reported relate only to the the samples submitted as received.*

I certify under penalty of law that this document and all ATTACHMENTs were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: September 15, 2017
*(Date)*

*(Authorized signature)*

John Williams
Director
Aquatec Environmental, Inc.

Chain-Of-Custody(s)

# Chain of Custody Record

Aquatec

AECOM
8000 Virginia Manor Road, Suite 110, Beltsville, MD
20705
(301) 289-3900 Phone (301) 289-3901 Fax

AECOM

| | | |
|---|---|---|
| Project Name: PEPCO Benning Rd- Waterside Investigation | Project Location: PEPCO Benning Road | Page 1 of 2 |
| Project Number: 60340344 | Project #: 60340344 | |
| Sampler (print name) (Affiliation) Daniel Hurbert AECOM | Chain of Custody Tape No. | |
| Signature | Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.com | TAT Standard |

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SED6C00EN | 6/7/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | |
| SED8C00EN | 6/7/17 | 1130 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7B00EN | 6/7/17 | 1230 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7F00EN | 6/8/17 | 0830 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7.5E00EN | 6/8/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6.5E00EN | 6/8/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7E00EN | 6/8/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6B00EN | 6/8/17 | 1230 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6A00EN | 6/8/17 | 1315 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7.5D00EN | 6/9/17 | 0815 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7D00EN | 6/9/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6.5D00EN | 6/9/17 | 0945 | | X | 1-gal | Sed | — | 1 | H | | |
| SED8A00EN | 6/9/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7A00EN | 6/9/17 | 1115 | | X | 1-gal | Sed | — | 1 | H | | |
| SED8B00EN | 6/9/17 | 1200 | | X | 1-gal | Sed | — | 1 | H | | |

Analysis Required

| Reliquished By (Print Name) | Date/Time | Received By (Print Name) | Date/Time |
|---|---|---|---|
| Daniel Hurbert; Signature: | Date: ; Time: | Matt Emery; Signature: | Date: 6/9/17; Time: 1435 |
| Reliquished By (Print Name); Signature: | Date: 6/15/17; Time: 10:40 | Received By (Print Name): Kendra J Nash; Signature: | Date: 6/15/17; Time: 16:35 |
| Reliquished By (Print Name); Signature: | Date: ; Time: | Received By (Print Name); Signature: | Date: ; Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

Samples received in coolers - well iced.

# Chain of Custody Record

Aquatec

AECOM
8000 Virginia Manor Road, Suite 110, Beltsville, MD
20705
(301) 289-3900 Phone (301) 289-3901 Fax

AECOM



Project Name: PEPCO Benning Rd- Waterside Investigation

Project Location: PEPCO Benning Road

Project Number: 60340344

Project #: 60340344

Sampler (print name) (Affiliation): Daniel Hulbert AECOM

Chain of Custody Tape No.

Signature: [signature]

Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.com

TAT: Standard

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SEDBACK1600N | 6/12/17 | 1015 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK1700N | 6/12/17 | 1206 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK1800N | 6/12/17 | 1315 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK1900N | 6/13/17 | 0800 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK2000N | 6/13/17 | 0945 | | X | 1-gal | Sed | — | 1 | X | | |

| Reliquished By (Print Name) | Date / Time | Received By (Print Name) | Date / Time |
|---|---|---|---|
| Daniel Hulbert; Signature: [signature] | Date: 6/13/17; Time: | Received By (Print Name): ; Signature: | Date: ; Time: |
| Reliquished By (Print Name): ; Signature: | Date: 6/15/17; Time: 10:40 | Kendra J Nash; Signature: [signature] | Date: 6/15/17; Time: 16:35 |
| Reliquished By (Print Name): ; Signature: | Date: ; Time: | Received By (Print Name): ; Signature: | Date: ; Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

Samples received in coolers - well iced

AECOM/KENNEDY
17022
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# Chain of Custody Record

Aquatec

AECOM
8000 Virginia Manor Road, Suite 110, Beltsville, MD 20705
(301) 289-3900 Phone (301) 289-3901 Fax

AECOM

| | | |
|---|---|---|
| Project Name: PEPCO Benning Rd- Waterside Investigation | Project Location: PEPCO Benning Road | Page 1 of 2 |
| Project Number: 60340344 | Project #: 60340344 | |
| Sampler (print name) (Affiliation) Daniel Hubert AECOM | Chain of Custody Tape No. | |
| Signature | Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.com | TAT: Standard |

Analysis Required

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | (1) Remarks Cooler temperatures °C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SED6C00EN | 6/7/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | 1.4 (Temp Blank) |
| SED8C00EN | 6/7/17 | 1130 | | X | 1-gal | Sed | — | 1 | H | | 1.4 |
| SED7B00EN | 6/8/17 | 1230 | | X | 1-gal | Sed | — | 1 | H | | 1.4 |
| SED7F00EN | 6/8/17 | 0830 | | X | 1-gal | Sed | — | 1 | H | | 1.3 |
| SED7.5E00EN | 6/8/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED6.5E00EN | 6/8/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | 1.3 |
| SED7E00EN | 6/8/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | 1.3 |
| SED6B00EN | 6/8/17 | 1230 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED6A00EN | 6/8/17 | 1315 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED7.5D00EN | 6/9/17 | 0815 | | X | 1-gal | Sed | — | 1 | H | | ~~1.2~~ 1.4 |
| SED7D00EN | 6/9/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED6.5D00EN | 6/9/17 | 0945 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED8A00EN | 6/9/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED7A00EN | 6/9/17 | 1115 | | X | 1-gal | Sed | — | 1 | H | | 1.1 |
| SED8B00EN | 6/9/17 | 1200 | | X | 1-gal | Sed | — | 1 | H | | 1.1 |

6/15/17

| | | | |
|---|---|---|---|
| Relinquished By (Print Name) Daniel Hubert<br>Signature: | Date:<br>Time: | Received By (Print Name) Matt Emery<br>Signature: | Date: 6/9/17<br>Time: 1435 |
| Relinquished By (Print Name)<br>Signature: | Date:<br>Time: | Received By (Print Name)<br>Signature: | Date:<br>Time: |
| Relinquished By (Print Name)<br>Signature: | Date:<br>Time: | Received By (Print Name)<br>Signature: | Date:<br>Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

(1) Record of temperatures for samples as received (temperature blanks) 6/15/17

# Chain of Custody Record

Aquatec

COPY

AECOM
8000 Virginia Manor Road, Suite 110, Beltsville, MD
20705
(301) 289-3900 Phone (301) 289-3901 Fax

AECOM

| | | |
|---|---|---|
| Project Name: PEPCO Benning Rd- Waterside Investigation | Project Location: PEPCO Benning Road | Page 2 of 2 |
| Project Number: 60340344 | Project #: 60340344 | |
| Sampler (print name) (Affiliation) Daniel Hubert AECOM | Chain of Custody Tape No. | |
| Signature | Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.com | TAT Standard |

Analysis Required

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | ① Remarks Cooler Temperatures °C (Temp Blanks) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SEDBACK1600N | 6/12/17 | 1015 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK1700N | 6/12/17 | 1206 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK1800N | 6/12/17 | 1315 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK1900N | 6/13/17 | 0800 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK2000N | 6/13/17 | 0945 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |

6/15/17

| Relinquished By (Print Name) | Date: | Received By (Print Name) | Date: |
|---|---|---|---|
| Daniel Hubert; Signature: [signature] | 6/13/17; Time: | Signature: | Time: |
| Relinquished By (Print Name); Signature: | Date:; Time: | Received By (Print Name); Signature: | Date:; Time: |
| Relinquished By (Print Name); Signature: | Date:; Time: | Received By (Print Name); Signature: | Date:; Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

① Record of temperature blanks for samples as received (temperature blanks) 6/15/17

10:40

Page: ___ of ___

# Aquatec Environmental, Inc.

## Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

| COMPANY INFORMATION | PROJECT INFORMATION | VOLUME/CONTAINER TYPE/ PRESERVATIVE |
|---|---|---|
| NAME: | PROJECT: | Gallons, HDPE Bucket |
| ADDRESS: | | |
| | PROJECT #: | |
| TEL: | SAMPLERS NAME(S): | |
| CONTACT: | | |
| E-MAIL: | PERMIT NUMBER: | |

| SAMPLE IDENTIFICATION | COLLECTION DATE | COLLECTION TIME | GRAB | COMPOSITE | MATRIX | NUMBER OF CONTAINERS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lamoille River (sandy) | 6/19/17 | 08:00 | X | | SED | 2-3 | | | | | | | |
| Lake Arrowhead (soft mud) | 6/19/17 | 08:30 | X | | SED | 2-3 | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

ANALYSIS (TEST/DETECTION LIMITS) –

| RELINQUISHED BY: (Signature) | DATE: | TIME: | RECEIVED BY: (Signature) |
|---|---|---|---|
| | 6/19/17 | 09:30 | |
| RELINQUISHED BY: (Signature) | DATE: | TIME: | RECEIVED BY: (Signature) |
| | | | |
| RELINQUISHED BY: (Signature) | DATE: | TIME: | RECEIVED BY: (Signature) |
| | | | |

TEMPERATURE ON DELIVERY (°C):

NOTES:
Sediments sieved (0.5 mm) in field. Blended as Control sediment

SAMPLE ACCEPTANCE POLICY AND RECOMMENDATIONS:

1) Proper, full, and complete documentation on the Chain-of-Custody (sample ID, location, date and time of collection, sampler's name, preservation type, sample type (matrix) and any special remarks concerning the sample);
2) Proper and legible sample labeling with initials, date and time and use of appropriate containers;
3) Provide adequate sample volume and apply tape around caps to prevent dislodgement during shipping;
4) Ship samples with sufficient ice to maintain acceptable shipping temperature range of 0-6°C;
5) Samples should be received within specified holding times based on controlling regulations

***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report***

# Aquatec Environmental, Inc.

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AECOM
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Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com

**Client ID:** AECOM/Kennedy

## ALKALINITY AND HARDNESS REPORT:

**100.2** Midge, C. dilutus, 10-D Survival and Growth
Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

Day 0

| Sample ID: | Analysis Date: | Alkalinity: (mg/L) | Hardness: (mg/L) |
|---|---|---|---|
| 50413 - CONTROL | 8/1/2017 | 88.0 | 100.0 |
| 50415 - SED6C00EN | 8/1/2017 | 112.0 | 108.0 |
| 50416 - SED8C00EN | 8/1/2017 | 96.0 | 96.0 |
| 50417 - SED7B00EN | 8/1/2017 | 108.0 | 100.0 |
| 50418 - SED7F00EN | 8/1/2017 | 100.0 | 112.0 |
| 50419 - SED7.5E00EN | 8/1/2017 | 100.0 | 104.0 |
| 50420 - SED6.5E00EN | 8/1/2017 | 116.0 | 112.0 |
| 50421 - SED7E00EN | 8/1/2017 | 100.0 | 104.0 |
| 50422 - SED6B00EN | 8/1/2017 | 108.0 | 112.0 |
| 50423 - SED6A00EN | 8/1/2017 | 128.0 | 124.0 |
| 50424 - SED7.5D00EN | 8/1/2017 | 92.0 | 104.0 |
| 50425 - SED7D00EN | 8/1/2017 | 96.0 | 100.0 |
| 50426 - SED6.5D00EN | 8/1/2017 | 104.0 | 116.0 |
| 50427 - SED8A00EN | 8/1/2017 | 116.0 | 124.0 |
| 50428 - SED7A00EN | 8/1/2017 | 144.0 | 104.0 |
| 50429 - SED8B00EN | 8/1/2017 | 136.0 | 112.0 |
| 50430 - SEDBACK1600N | 8/1/2017 | 136.0 | 120.0 |
| 50431 - SEDBACK1700N | 8/1/2017 | 136.0 | 120.0 |
| 50432 - SEDBACK1800N | 8/1/2017 | 104.0 | 124.0 |
| 50433 - SEDBACK1900N | 8/1/2017 | 116.0 | 136.0 |
| 50434 - SEDBACK2000N | 8/1/2017 | 148.0 | 104.0 |

*INF: Interference. The color endpoint was reached immediatel*

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# ALKALINITY AND HARDNESS REPORT:

**100.2** Midge, C. dilutus, 10-D Survival and Growth
Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

Day 9

| Sample ID: | Analysis Date: | Alkalinity: (mg/L) | Hardness: (mg/L) |
|---|---|---|---|
| 50413 - CONTROL | 8/10/2017 | 96.0 | 108.0 |
| 50415 - SED6C00EN | 8/10/2017 | 84.0 | 100.0 |
| 50416 - SED8C00EN | 8/10/2017 | 80.0 | 132.0 |
| 50417 - SED7B00EN | 8/10/2017 | 84.0 | 108.0 |
| 50418 - SED7F00EN | 8/10/2017 | 92.0 | 112.0 |
| 50419 - SED7.5E00EN | 8/10/2017 | 88.0 | 116.0 |
| 50420 - SED6.5E00EN | 8/10/2017 | 104.0 | 116.0 |
| 50421 - SED7E00EN | 8/10/2017 | 100.0 | 120.0 |
| 50422 - SED6B00EN | 8/10/2017 | 88.0 | 128.0 |
| 50423 - SED6A00EN | 8/10/2017 | 88.0 | 100.0 |
| 50424 - SED7.5D00EN | 8/10/2017 | 104.0 | 120.0 |
| 50425 - SED7D00EN | 8/10/2017 | 92.0 | 104.0 |
| 50426 - SED6.5D00EN | 8/10/2017 | 104.0 | 112.0 |
| 50427 - SED8A00EN | 8/10/2017 | 108.0 | 112.0 |
| 50428 - SED7A00EN | 8/10/2017 | 96.0 | 112.0 |
| 50429 - SED8B00EN | 8/10/2017 | 100.0 | 112.0 |
| 50430 - SEDBACK1600N | 8/10/2017 | 132.0 | 136.0 |
| 50431 - SEDBACK1700N | 8/10/2017 | 104.0 | 112.0 |
| 50432 - SEDBACK1800N | 8/10/2017 | 112.0 | 104.0 |
| 50433 - SEDBACK1900N | 8/10/2017 | 96.0 | 104.0 |
| 50434 - SEDBACK2000N | 8/10/2017 | 100.0 | 120.0 |

*INF: Interference. The color endpoint was reached immediatel*



**Aquatec Environmental, Inc.**
Reviewed by: JJV Date: 9/13/17.

**SDG:** 15151
**Project** 17022

# Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Project:** Pepco Benning Road Facility

## AMMONIA ANALYSIS REPORT:

| Sample: | Pore Water (mg/L) | Overlying Water (mg/L) | |
|---|---|---|---|
| | 7/28/2017 | 8/1/2017 | 8/10/2017 |
| 50413 / CONTROL | 26.3 | 2.6 | 0.9 |
| 50415 / SED6C00EN | 21.9 | 2.8 | 0.6 |
| 50416 / SED8C00EN | 40.9 | 0.9 | 0.4 |
| 50417 / SED7B00EN | 5.1 | 2.7 | 0.4 |
| 50418 / SED7F00EN | 17.3 | 2.2 | 1.3 |
| 50419 / SED7.5E00EN | 12.6 | 2.0 | 1.3 |
| 50420 / SED6.5E00EN | 20.3 | 3.5 | 1.5 |
| 50421 / SED7E00EN | 13.5 | 1.6 | 1.0 |
| 50422 / SED6B00EN | 9.2 | 1.7 | 0.4 |
| 50423 / SED6A00EN | 14.3 | 1.9 | 0.4 |
| 50424 / SED7.5D00EN | 9.8 | 1.4 | 0.6 |
| 50425 / SED7D00EN | 29.3 | 2.7 | 0.5 |
| 50426 / SED6.5D00EN | 31.8 | 4.1 | 0.9 |
| 50427 / SED8A00EN | 8.9 | 1.6 | 0.3 |
| 50428 / SED7A00EN | 17.2 | 1.3 | 1.6 |
| 50429 / SED8B00EN | 8.5 | 1.7 | 1.1 |
| 50430 / SEDBACK1600N | 17.9 | 3.0 | 4.2 |
| 50431 / SEDBACK1700N | 41.5 | 5.2 | 0.5 |
| 50432 / SEDBACK1800N | 35.7 | 4.1 | 0.3 |
| 50433 / SEDBACK1900N | 29.1 | 5.5 | 0.3 |
| 50434 / SEDBACK2000N | 27.4 | 5.0 | 0.6 |

*BD - Indicates a concentration value below the reporting limit (<0.1).*

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**Client ID:** AECOM/Kennedy

## SEDIMENT CHARACTERIZATION:



| Sample # | Client Sample ID | Sediment Characteristics | Pore Water pH | Organisms Present | Initial/ Date |
|---|---|---|---|---|---|
| 50413 | CONTROL<br>Sieved: Y / N 0.5mm Mesh size | Fine sand and silt | 7.0 | None seen | 7/27/17 |
| 50415 | SED6C00EN<br>Sieved: Y / N N Mesh size | Fine, cohesive sediment. Some sticks, lumpy | 6.7 | Not seen | |
| 50416 | SED8C00EN<br>Sieved: Y / N N Mesh size | Fine, cohesive sediment. Some sticks, lumpy | 6.8 | None seen | |
| 50417 | SED7B00EN<br>Sieved: Y / N N Mesh size | Fine, cohesive sediment. | 6.8 | possible dead clam, small | |
| 50418 | SED7F00EN<br>Sieved: Y / N N Mesh size | Fine, cohesive sediment. Some sticks, leaves, lumpy | 6.7 | None seen | |
| 50419 | SED7.5E00EN<br>Sieved: Y / N N Mesh size | Fine, cohesive sediment, some sticks, leaves, lumpy | 6.6 | None seen | |
| 50420 | SED6.5E00EN<br>Sieved: Y / N N Mesh size | Gritty sediment with stones, | 6.7 | None seen | |
| 50421 | SED7E00EN<br>Sieved: Y / N N Mesh size | Fluid mud with rocks and sticks | 6.8 | None seen | |

Aquatec Environmental, Inc.
Reviewed by: JW Date: 9/9/17

SDG: 15151
Project 17022

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**Client ID:** AECOM/Kennedy

## SEDIMENT CHARACTERIZATION:



| Sample # | Client Sample ID | Sieved: Y / N | Mesh size | Sediment Characteristics | Pore Water pH | Organisms Present | Initial/ Date |
|---|---|---|---|---|---|---|---|
| 50422 | SED6B00EN | N | | Soft mud and sand, lots of sticks and leaf litter | 6.7 | None seen | 7/27/17 |
| 50423 | SED6A00EN | N | | Soft mud full of detritus light brown in color | 6.6 | None seen | |
| 50424 | SED7.5D00EN | N | | Milk chocolate Brown color Soft mud | 6.8 | None Seen | |
| 50425 | SED7D00EN | N | | Soft cohesive sediment with few sticks | 6.8 | None seen | |
| 50426 | ED6.5D00EN | N | | loose soopy sediment with lots of sticks + Rocks | 6.6 | None seen | |
| 50427 | SED8A00EN | N | | Soft cohesive sediment few sticks present | 6.8 | None Seen | |
| 50428 | SED7A00EN | N | | Fine cohesive sediment Some sticks | 6.7 | None Seen | |
| 50429 | SED8B00EN | N | | Soft mud & sand, grit Leaf litter | 6.7 | 1 large snail | |
| 50430 | SEDBACK1600N | Y | 2.8 mm | mostly sticks, leaf litter, detritus | 6.6 | None seen | |

**Aquatec Environmental, Inc.**
Reviewed by: [initials] Date: 9/9/17.

SDG: 15151
Project 17022

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**Client ID:** AECOM/Kennedy

## SEDIMENT CHARACTERIZATION:



| Sample # | Client Sample ID | Sediment Characteristics | Pore Water pH | Organisms Present | Initial/ Date |
|---|---|---|---|---|---|
| 50431 | SEDBACK1700N<br>Sieved: Y / N N Mesh size | loose fluid sediment with a lot of detritus | 6.5 | None Seen | |
| 50432 | SEDBACK1800N<br>Sieved: Y / N N Mesh size | gritty sediment full of Rocks and debris, fluid | 6.7 | None seen | |
| 50433 | SEDBACK1900N<br>Sieved: Y / N N Mesh size | Stones and gravel, some very fluid sediment. Allowing stones to settle ~~and pollin~~ before distributing fluid sediment to beakers. Some sticks and leaf litter | 6.9 | None seen | |
| 50434 | SEDBACK2000N<br>Sieved: Y / N N Mesh size | fluid sediment, lots of detritus | 6.6 | None seen | |

# Toxicity Test Method(s)

# 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Project:** Pepco Benning Road Facility

| | | |
|---|---|---|
| 1 | Test type: | Whole-sediment toxicity test with renewal of overlying water |
| 2 | Temperature: | 23 +/- 1C |
| 3 | Light quality: | Wide-spectrum fluorescent lights |
| 4 | Illuminance: | About 100 to 1000lux |
| 5 | Photoperiod: | 16L:8D |
| 6 | Test chamber: | 300 mL high-form beaker |
| 7 | Sediment volume: | 100 mL |
| 8 | Overlying water volume: | 175 mL |
| 9 | Renewal of overlying water: | 2 volume additions/day (e.g. 1 volume addition every 12h) |
| 10 | Age of organisms: | Second to third-instar larvae (about 8-10 day old larvae) |
| 11 | No. of organisms/chamber: | 10 |
| 12 | No. of replicates/treatment: | 8 |
| 13 | Feeding: | Tetrafin goldfish food, fed 1.5 mL daily to each test chamber (1.5 mL contains 6.0 mg of dry solids) |
| 14 | Aeration: | Gentle aeration is typically provided. Experience has shown dissolved oxygen often declines during this test. |
| 15 | Overlying water: | Reconstituted water |
| 16 | Test chamber cleaning: | If screens become clogged during a test, gently brush the outside of the screen |
| 17 | Overlying water quality: | Hardness, alkalinity, conductivity, pH, and ammonia at the beginning and end of a test (e.g. Days 0 and 9). Temperature and dissolved oxygen daily. |
| 18 | Test duration: | 10 days |
| 19 | Endpoints: | Survival and growth (ash-free dry weight, AFDW) |
| 20 | Test acceptability: | Minimum mean control survival must be 70%, with minimum mean weight/surviving control organism of 0.48mg AFDW. |

# 100.2 - Midge, C. dilutus, 10-D Survival and Growth

*Chironomus dilutus*

10-day survival and

growth test (ash-free dry weight)

Statistical analysis of test data compared to

CONTROL

(Aquatec Sample # 50413)

STATISTICAL COMPARISON TO CONTROL (50413

## CETIS Summary Report


Test Code: 80686 | 10-3662-4765

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 11-1986-8050 | **Test Type:** | Survival-AF Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 01 Aug-17 19:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 11 Aug-17 16:45 | **Species:** | Chironomus dilutus | **Brine:** | |
| **Duration:** | 9d 21h | **Source:** | Aquatic Biosystems, CO | **Age:** | |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 11-8452-6517 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1129 | 50415 passed mean af weight-mg |
| 14-2631-3761 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.0974 | 50416 passed mean af weight-mg |
| 17-3962-8062 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 4.1E-04 | 50417 failed mean af weight-mg |
| 15-7405-3558 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.4240 | 50418 passed mean af weight-mg |
| 13-8258-5566 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0257 | 50419 failed mean af weight-mg |
| 18-8697-4046 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.6008 | 50420 passed mean af weight-mg |
| 05-7273-3946 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.2869 | 50421 passed mean af weight-mg |
| 19-8151-2355 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.3345 | 50422 passed mean af weight-mg |
| 04-2479-1526 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.6129 | 50423 passed mean af weight-mg |
| 09-8773-5221 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0858 | 50424 passed mean af weight-mg |
| 01-3995-2218 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.3605 | 50425 passed mean af weight-mg |
| 07-8443-5390 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.2416 | 50426 passed mean af weight-mg |
| 12-3536-9124 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.6876 | 50427 passed mean af weight-mg |
| 02-1896-4457 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.7131 | 50428 passed mean af weight-mg |
| 10-5045-7402 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.8359 | 50429 passed mean af weight-mg |
| 19-9991-2133 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.9977 | 50430 passed mean af weight-mg |
| 15-4036-3940 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.3605 | 50431 passed mean af weight-mg |
| 10-8650-8403 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.8621 | 50432 passed mean af weight-mg |
| 07-7643-0581 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.5708 | 50433 passed mean af weight-mg |
| 08-9983-3152 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.9859 | 50434 passed mean af weight-mg |
| 20-5788-0120 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7751 | 50415 passed survival rate |
| 09-0060-3299 | Survival Rate | Equal Variance t Two-Sample Test | 0.0564 | 50416 passed survival rate |
| 14-3174-0835 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3497 | 50417 passed survival rate |
| 03-4782-0105 | Survival Rate | Equal Variance t Two-Sample Test | 0.1160 | 50418 passed survival rate |
| 14-5457-3498 | Survival Rate | Equal Variance t Two-Sample Test | 0.6844 | 50419 passed survival rate |
| 12-8999-4227 | Survival Rate | Unequal Variance t Two-Sample Test | 0.4607 | 50420 passed survival rate |
| 16-4056-1501 | Survival Rate | Equal Variance t Two-Sample Test | 0.7973 | 50421 passed survival rate |
| 17-9681-4874 | Survival Rate | Equal Variance t Two-Sample Test | 0.6844 | 50422 passed survival rate |
| 14-9651-1154 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50423 passed survival rate |
| 14-4503-0177 | Survival Rate | Equal Variance t Two-Sample Test | 0.2072 | 50424 passed survival rate |
| 14-4230-2257 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50425 passed survival rate |
| 03-0386-2416 | Survival Rate | Equal Variance t Two-Sample Test | 0.0376 | 50426 failed survival rate |
| 04-9615-5807 | Survival Rate | Unequal Variance t Two-Sample Test | 0.1832 | 50427 passed survival rate |
| 16-3229-2877 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.0971 | 50428 passed survival rate |
| 03-3091-1468 | Survival Rate | Equal Variance t Two-Sample Test | 0.3329 | 50429 passed survival rate |
| 17-9537-7548 | Survival Rate | Equal Variance t Two-Sample Test | 0.0466 | 50430 failed survival rate |
| 19-6838-1445 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50431 passed survival rate |
| 01-5185-2082 | Survival Rate | Equal Variance t Two-Sample Test | 0.1397 | 50432 passed survival rate |
| 21-3937-9031 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7751 | 50433 passed survival rate |
| 15-8387-2681 | Survival Rate | Equal Variance t Two-Sample Test | 0.1189 | 50434 passed survival rate |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

**Mean AF Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 1.888 | 1.662 | 2.113 | 1.66 | 2.505 | 0.0953 | 0.2696 | 14.28% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.38 | 2.088 | 0.06959 | 0.1968 | 11.32% | 7.92% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.544 | 1.921 | 0.05377 | 0.1521 | 8.79% | 8.32% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.156 | 1.712 | 0.06052 | 0.1712 | 12.15% | 25.37% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.641 | 2.186 | 0.06328 | 0.179 | 9.59% | 1.18% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.305 | 1.911 | 0.069 | 0.1952 | 11.92% | 13.27% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.647 | 2.493 | 0.09311 | 0.2634 | 13.88% | -0.49% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.681 | 1.941 | 0.02893 | 0.08183 | 4.58% | 5.39% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.599 | 2.031 | 0.05696 | 0.1611 | 8.76% | 2.57% |
| 50423 | | 8 | 1.934 | 1.636 | 2.232 | 1.494 | 2.557 | 0.126 | 0.3564 | 18.43% | -2.45% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.391 | 1.972 | 0.06438 | 0.1821 | 10.57% | 8.78% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.651 | 2.58 | 0.1087 | 0.3076 | 16.40% | 0.63% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.354 | 2.228 | 0.1016 | 0.2875 | 16.08% | 5.32% |
| 50427 | | 8 | 1.956 | 1.726 | 2.186 | 1.595 | 2.285 | 0.09731 | 0.2752 | 14.07% | -3.61% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.699 | 2.092 | 0.05194 | 0.1469 | 7.84% | 0.74% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.77 | 1.981 | 0.03076 | 0.08699 | 4.63% | 0.42% |
| 50430 | | 8 | 2.37 | 2.119 | 2.621 | 2.083 | 3.014 | 0.1061 | 0.3 | 12.66% | -25.56% |
| 50431 | | 8 | 1.802 | 1.681 | 1.923 | 1.612 | 1.994 | 0.05107 | 0.1445 | 8.02% | 4.53% |
| 50432 | | 8 | 2.05 | 1.797 | 2.304 | 1.519 | 2.435 | 0.1072 | 0.3032 | 14.79% | -8.62% |
| 50433 | | 8 | 1.918 | 1.601 | 2.235 | 1.422 | 2.552 | 0.134 | 0.3791 | 19.77% | -1.58% |
| 50434 | | 8 | 2.088 | 1.862 | 2.313 | 1.839 | 2.67 | 0.09531 | 0.2696 | 12.91% | -10.60% |

**Survival Rate Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.9125 | 0.8829 | 0.9421 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.87% | 0.00% |
| 50415 | | 8 | 0.9125 | 0.8184 | 1.0000 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.34% | 0.00% |
| 50416 | | 8 | 0.8500 | 0.7726 | 0.9274 | 0.7000 | 1.0000 | 0.0327 | 0.0926 | 10.89% | 6.85% |
| 50417 | | 8 | 0.8875 | 0.8177 | 0.9573 | 0.8000 | 1.0000 | 0.0295 | 0.0835 | 9.40% | 2.74% |
| 50418 | | 8 | 0.8750 | 0.8159 | 0.9341 | 0.8000 | 1.0000 | 0.0250 | 0.0707 | 8.08% | 4.11% |
| 50419 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -1.37% |
| 50420 | | 8 | 0.9000 | 0.8001 | 0.9999 | 0.7000 | 1.0000 | 0.0423 | 0.1195 | 13.28% | 1.37% |
| 50421 | | 8 | 0.9375 | 0.8609 | 1.0000 | 0.8000 | 1.0000 | 0.0324 | 0.0916 | 9.77% | -2.74% |
| 50422 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -1.37% |
| 50423 | | 8 | 0.8750 | 0.7776 | 0.9724 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 13.31% | 4.11% |
| 50424 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.7000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | 4.11% |
| 50425 | | 8 | 0.8875 | 0.8046 | 0.9704 | 0.7000 | 1.0000 | 0.0350 | 0.0991 | 11.17% | 2.74% |
| 50426 | | 8 | 0.8250 | 0.7276 | 0.9224 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 14.12% | 9.59% |
| 50427 | | 8 | 0.8500 | 0.7236 | 0.9764 | 0.6000 | 1.0000 | 0.0535 | 0.1512 | 17.79% | 6.85% |
| 50428 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.8000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | 4.11% |
| 50429 | | 8 | 0.8875 | 0.7934 | 0.9816 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.69% | 2.74% |
| 50430 | | 8 | 0.8375 | 0.7488 | 0.9262 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 12.66% | 8.22% |
| 50431 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | 1.37% |
| 50432 | | 8 | 0.8625 | 0.7738 | 0.9512 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 12.30% | 5.48% |
| 50433 | | 8 | 0.9000 | 0.7818 | 1.0000 | 0.6000 | 1.0000 | 0.0500 | 0.1414 | 15.71% | 1.37% |
| 50434 | | 8 | 0.8500 | 0.7405 | 0.9595 | 0.6000 | 1.0000 | 0.0463 | 0.1309 | 15.40% | 6.85% |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 03-0386-2416 | **Endpoint:** | Survival Rate | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:00 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 43d 11h | Aquatec Environmental, I | Sediment Testing |
| 50426 | 17-5556-0091 | 09 Jun-17 09:45 | 15 Jun-17 16:35 | 53d 10h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50426 | Sediment | PEPCO Benning Rd-Waterside In | SED6.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Angular (Corrected) | C > T | 50426 failed survival rate | 7.53% |

### Equal Variance t Two-Sample Test

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50426* | 1.922 | 1.761 | 0.105 | 14 | CDF | 0.0376 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0523912 | 0.0523912 | 1 | 3.692 | 0.0753 | Non-Significant Effect |
| Error | 0.198654 | 0.0141896 | 14 | | | |
| Total | 0.251045 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 7.548 | 8.885 | 0.0161 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8993 | 0.8408 | 0.0782 | Normal Distribution |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.9125 | 0.8829 | 0.9421 | 0.9000 | 0.9000 | 1.0000 | 0.0125 | 3.87% | 0.00% |
| 50426 | | 8 | 0.8250 | 0.7276 | 0.9224 | 0.8500 | 0.7000 | 1.0000 | 0.0412 | 14.12% | 9.59% |

### Angular (Corrected) Transformed Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 1.269 | 1.221 | 1.318 | 1.249 | 1.249 | 1.412 | 0.02037 | 4.54% | 0.00% |
| 50426 | | 8 | 1.155 | 1.023 | 1.287 | 1.178 | 0.9912 | 1.412 | 0.05597 | 13.71% | 9.02% |

### Survival Rate Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.9000 | 0.9000 | 0.9000 | 0.9000 | 0.9000 | 1.0000 | 0.9000 | 0.9000 |
| 50426 | | 0.9000 | 0.7000 | 0.9000 | 0.8000 | 0.7000 | 0.7000 | 1.0000 | 0.9000 |

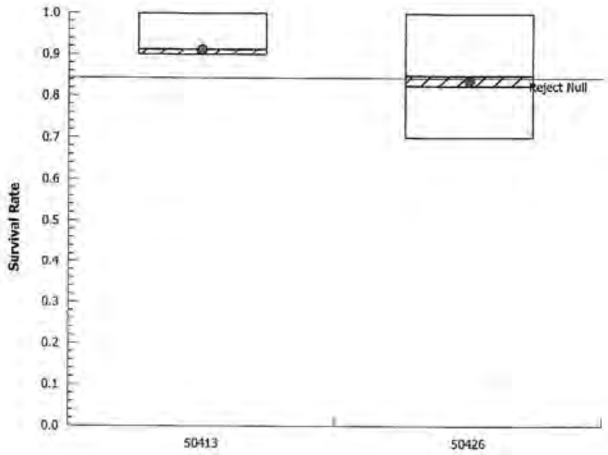
### Angular (Corrected) Transformed Detail

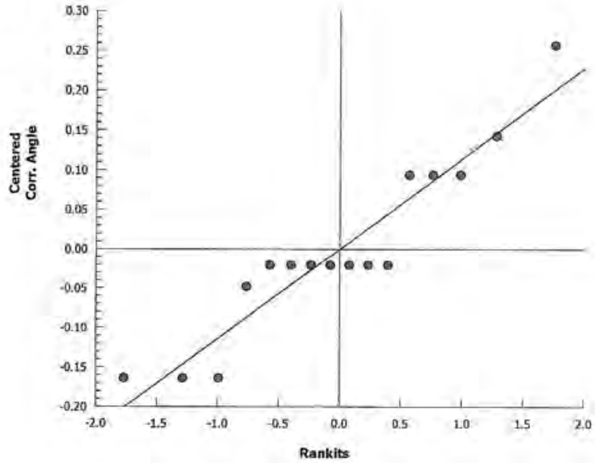
| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 1.249 | 1.249 | 1.249 | 1.249 | 1.249 | 1.412 | 1.249 | 1.249 |
| 50426 | | 1.249 | 0.9912 | 1.249 | 1.107 | 0.9912 | 0.9912 | 1.412 | 1.249 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 03-0386-2416 | **Endpoint:** | Survival Rate | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:00 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

**Graphics**



# CETIS Analytical Report

Report Date: 15 Sep-17 11:33 (p 1 of 2)
Test Code: 80686 | 10-3662-4765

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-9537-7548 | **Endpoint:** | Survival Rate | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:00 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 43d 11h | Aquatec Environmental, I | Sediment Testing |
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Angular (Corrected) | C > T | 50430 failed survival rate | 6.96% |

### Equal Variance t Two-Sample Test

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50430* | 1.801 | 1.761 | 0.098 | 14 | CDF | 0.0466 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0399573 | 0.0399573 | 1 | 3.244 | 0.0932 | Non-Significant Effect |
| Error | 0.172424 | 0.012316 | 14 | | | |
| Total | 0.212381 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 6.419 | 8.885 | 0.0254 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9103 | 0.8408 | 0.1175 | Normal Distribution |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.9125 | 0.8829 | 0.9421 | 0.9000 | 0.9000 | 1.0000 | 0.0125 | 3.87% | 0.00% |
| 50430 | | 8 | 0.8375 | 0.7488 | 0.9262 | 0.8500 | 0.7000 | 1.0000 | 0.0375 | 12.66% | 8.22% |

### Angular (Corrected) Transformed Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 1.269 | 1.221 | 1.318 | 1.249 | 1.249 | 1.412 | 0.02037 | 4.54% | 0.00% |
| 50430 | | 8 | 1.169 | 1.047 | 1.292 | 1.178 | 0.9912 | 1.412 | 0.05161 | 12.48% | 7.87% |

### Survival Rate Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.9000 | 0.9000 | 0.9000 | 0.9000 | 0.9000 | 1.0000 | 0.9000 | 0.9000 |
| 50430 | | 0.8000 | 0.8000 | 0.7000 | 0.9000 | 0.7000 | 0.9000 | 1.0000 | 0.9000 |

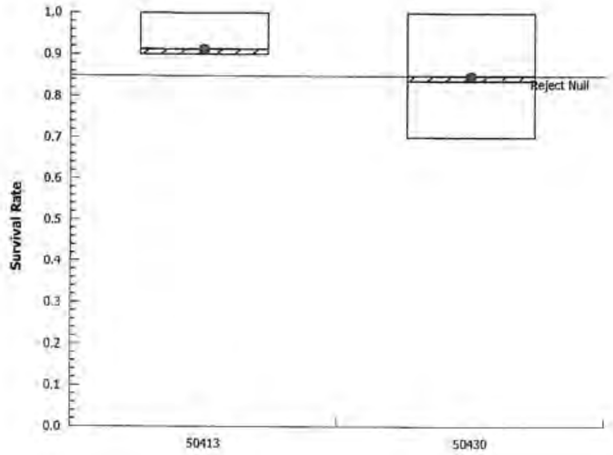
### Angular (Corrected) Transformed Detail

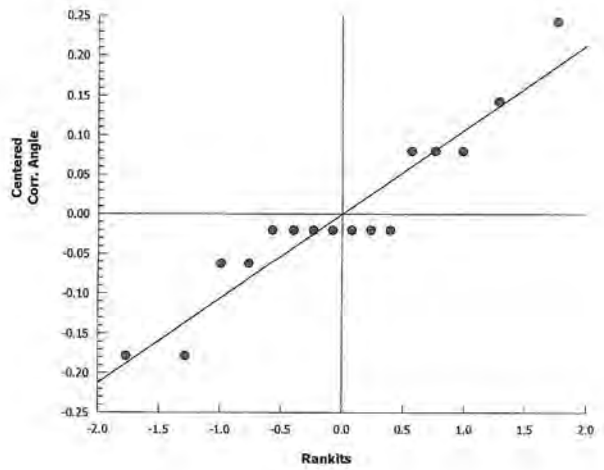
| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 1.249 | 1.249 | 1.249 | 1.249 | 1.249 | 1.412 | 1.249 | 1.249 |
| 50430 | | 1.107 | 1.107 | 0.9912 | 1.249 | 0.9912 | 1.249 | 1.412 | 1.249 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-9537-7548 | **Endpoint:** | Survival Rate | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:00 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

**Graphics**



**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-3962-8062 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 13:23 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 43d 11h | Aquatec Environmental, I | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 55d 7h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean af weight-mg | 10.53% |

### Equal Variance t Two-Sample Test

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50417* | 4.241 | 1.761 | 0.199 | 14 | CDF | 4.1E-04 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.917201 | 0.917201 | 1 | 17.99 | 8.2E-04 | Significant Effect |
| Error | 0.713781 | 0.0509844 | 14 | | | |
| Total | 1.63098 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.479 | 8.885 | 0.2539 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8609 | 0.8408 | 0.0198 | Normal Distribution |

### Mean AF Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 1.888 | 1.662 | 2.113 | | 1.66 | 2.505 | 0.0953 | 14.28% | 0.00% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | | 1.156 | 1.712 | 0.06052 | 12.15% | 25.37% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 1.819 | 1.767 | 1.889 | 1.66 | 1.763 | 1.712 | 1.987 | 2.505 |
| 50417 | | 1.509 | 1.5 | 1.261 | 1.712 | 1.33 | 1.156 | 1.363 | 1.44 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 13-8258-5566 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 13:23 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 43d 11h | Aquatec Environmental, I | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 54d 10h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean af weight-mg | 10.98% |

**Equal Variance t Two-Sample Test**

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50419* | 2.129 | 1.761 | 0.207 | 14 | CDF | 0.0257 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.25107 | 0.25107 | 1 | 4.534 | 0.0515 | Non-Significant Effect |
| Error | 0.775262 | 0.0553759 | 14 | | | |
| Total | 1.02633 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.908 | 8.885 | 0.4135 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9126 | 0.8408 | 0.1282 | Normal Distribution |

**Mean AF Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 1.888 | 1.662 | 2.113 | | 1.66 | 2.505 | 0.0953 | 14.28% | 0.00% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | | 1.305 | 1.911 | 0.069 | 11.92% | 13.27% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 1.819 | 1.767 | 1.889 | 1.66 | 1.763 | 1.712 | 1.987 | 2.505 |
| 50419 | | 1.474 | 1.634 | 1.793 | 1.911 | 1.305 | 1.719 | 1.522 | 1.738 |

## CETIS Test Data Worksheet

**Report Date:** 08 Sep-17 13:22 (p 1 of 4)
**Test Code/ID:** 10-3662-4765/80686

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Start Date:** | 01 Aug-17 19:30 | **Species:** | Chironomus dilutus | **Sample Code:** | 50413 |
| **End Date:** | 11 Aug-17 16:45 | **Protocol:** | EPA/600/R-99/064 (2000) | **Sample Source:** | Internal Laboratory Testing |
| **Sample Date:** | 19 Jun-17 08:30 | **Material:** | Control Sediment | **Sample Station:** | Control |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | 1 | 75 | 10 | 9 | 2261.79 | 2247.24 | 8 | | | |
| 50413 | 2 | 128 | 10 | 9 | 2134.15 | 2123.55 | 6 | | | |
| 50413 | 3 | 4 | 10 | 9 | 2406.66 | 2393.44 | 7 | | | |
| 50413 | 4 | 52 | 10 | 9 | 2309.32 | 2294.38 | 9 | | | |
| 50413 | 5 | 3 | 10 | 9 | 2331.58 | 2319.24 | 7 | | | |
| 50413 | 6 | 146 | 10 | 10 | 2153.35 | 2137.94 | 9 | | | |
| 50413 | 7 | 157 | 10 | 9 | 2193.04 | 2185.09 | 4 | | | |
| 50413 | 8 | 136 | 10 | 9 | 2503.68 | 2493.66 | 4 | | | |
| 50415 | 1 | 55 | 10 | 9 | 2299.25 | 2286.92 | 7 | | | |
| 50415 | 2 | 87 | 10 | 9 | 2339.95 | 2325.75 | 8 | | | |
| 50415 | 3 | 24 | 10 | 10 | 2295.3 | 2284.82 | 6 | | | |
| 50415 | 4 | 79 | 10 | 8 | 2405.82 | 2393.04 | 7 | | | |
| 50415 | 5 | 88 | 10 | 7 | 2498.95 | 2488.51 | 5 | | | |
| 50415 | 6 | 167 | 10 | 10 | 2278.14 | 2268.15 | 6 | | | |
| 50415 | 7 | 34 | 10 | 10 | 2397.55 | 2387.89 | 7 | | | |
| 50415 | 8 | 28 | 10 | 10 | 2444.03 | 2430.72 | 8 | | | |
| 50416 | 1 | 66 | 10 | 8 | 2462.55 | 2449.1 | 7 | | | |
| 50416 | 2 | 127 | 10 | 10 | 2324.27 | 2307.53 | 10 | | | |
| 50416 | 3 | 27 | 10 | 9 | 2399.91 | 2384.98 | 9 | | | |
| 50416 | 4 | 39 | 10 | 9 | 2398.18 | 2384.28 | 9 | | | |
| 50416 | 5 | 134 | 10 | 8 | 2231.44 | 2220.49 | 7 | | | |
| 50416 | 6 | 58 | 10 | 9 | 2437.69 | 2425.83 | 7 | | | |
| 50416 | 7 | 41 | 10 | 7 | 2322.69 | 2309.34 | 7 | | | |
| 50416 | 8 | 7 | 10 | 8 | 2316.59 | 2305.31 | 6 | | | |
| 50417 | 1 | 85 | 10 | 8 | 2178.96 | 2166.89 | 8 | | | |
| 50417 | 2 | 135 | 10 | 9 | 2164.7 | 2152.7 | 8 | | | |
| 50417 | 3 | 105 | 10 | 9 | 2115.26 | 2106.43 | 7 | | | |
| 50417 | 4 | 62 | 10 | 8 | 2199.69 | 2189.42 | 6 | | | |
| 50417 | 5 | 73 | 10 | 10 | 2266.87 | 2253.57 | 10 | | | |
| 50417 | 6 | 161 | 10 | 10 | 2153.9 | 2143.5 | 9 | | | |
| 50417 | 7 | 165 | 10 | 9 | 2047.12 | 2034.85 | 9 | | | |
| 50417 | 8 | 145 | 10 | 8 | 2179.02 | 2168.94 | 7 | | | |
| 50418 | 1 | 130 | 10 | 8 | 2172.05 | 2160.19 | 6 | | | |
| 50418 | 2 | 108 | 10 | 8 | 2198.71 | 2185.35 | 7 | | | |
| 50418 | 3 | 38 | 10 | 9 | 2078.14 | 2061.64 | 9 | | | |
| 50418 | 4 | 56 | 10 | 9 | 2208 | 2197.59 | 6 | | | |
| 50418 | 5 | 6 | 10 | 9 | 2128.59 | 2115.46 | 8 | | | |
| 50418 | 6 | 74 | 10 | 10 | 2211.14 | 2197.63 | 8 | | | |
| 50418 | 7 | 124 | 10 | 9 | 2226.28 | 2208.7 | 9 | | | |
| 50418 | 8 | 162 | 10 | 8 | 2232.01 | 2221.08 | 5 | | | |
| 50419 | 1 | 153 | 10 | 10 | 2137.6 | 2122.86 | 10 | | | |
| 50419 | 2 | 119 | 10 | 10 | 2075.08 | 2058.74 | 10 | | | |
| 50419 | 3 | 10 | 10 | 9 | 2203.29 | 2187.15 | 9 | | | |
| 50419 | 4 | 131 | 10 | 8 | 2156.5 | 2143.12 | 7 | | | |
| 50419 | 5 | 61 | 10 | 10 | 2220.4 | 2207.35 | 10 | | | |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 26 | 10 | 9 | 2207.66 | 2193.91 | 8 | | | |
| 50419 | 7 | 160 | 10 | 10 | 2197.41 | 2185.23 | 8 | | | |
| 50419 | 8 | 154 | 10 | 8 | 2235.22 | 2224.79 | 6 | | | |
| 50420 | 1 | 133 | 10 | 10 | 2198.79 | 2180.89 | 10 | | | |
| 50420 | 2 | 44 | 10 | 8 | 2222.76 | 2211.32 | 6 | | | |
| 50420 | 3 | 109 | 10 | 9 | 2180.75 | 2167.6 | 7 | | | |
| 50420 | 4 | 32 | 10 | 7 | 2474.78 | 2459.82 | 6 | | | |
| 50420 | 5 | 113 | 10 | 10 | 2157.79 | 2146.15 | 7 | | | |
| 50420 | 6 | 15 | 10 | 10 | 2124.4 | 2111.22 | 8 | | | |
| 50420 | 7 | 20 | 10 | 8 | 2127.79 | 2114.35 | 7 | | | |
| 50420 | 8 | 100 | 10 | 10 | 2134.34 | 2117.45 | 9 | | | |
| 50421 | 1 | 143 | 10 | 10 | 2039.98 | 2024.45 | 8 | | | |
| 50421 | 2 | 13 | 10 | 10 | 2243.29 | 2228.16 | 9 | | | |
| 50421 | 3 | 115 | 10 | 8 | 2191.22 | 2178.52 | 7 | | | |
| 50421 | 4 | 35 | 10 | 10 | 2128.78 | 2114.79 | 8 | | | |
| 50421 | 5 | 148 | 10 | 9 | 2140.17 | 2128.31 | 7 | | | |
| 50421 | 6 | 29 | 10 | 10 | 2120.11 | 2103.95 | 9 | | | |
| 50421 | 7 | 16 | 10 | 10 | 2199.8 | 2185.26 | 8 | | | |
| 50421 | 8 | 118 | 10 | 8 | 2219.81 | 2205.45 | 8 | | | |
| 50422 | 1 | 141 | 10 | 10 | 2161.55 | 2145.53 | 9 | | | |
| 50422 | 2 | 121 | 10 | 8 | 2297.93 | 2285.49 | 7 | | | |
| 50422 | 3 | 42 | 10 | 8 | 2083.43 | 2069.21 | 7 | | | |
| 50422 | 4 | 144 | 10 | 10 | 2035.97 | 2024.78 | 7 | | | |
| 50422 | 5 | 140 | 10 | 9 | 2208.11 | 2196.89 | 6 | | | |
| 50422 | 6 | 117 | 10 | 10 | 2214.72 | 2200.73 | 7 | | | |
| 50422 | 7 | 47 | 10 | 10 | 2162.86 | 2149.53 | 8 | | | |
| 50422 | 8 | 158 | 10 | 9 | 2321.46 | 2309.51 | 6 | | | |
| 50423 | 1 | 106 | 10 | 7 | 2544.52 | 2535.91 | 4 | | | |
| 50423 | 2 | 17 | 10 | 7 | 2219.01 | 2205.81 | 6 | | | |
| 50423 | 3 | 93 | 10 | 9 | 2204.08 | 2190.81 | 8 | | | |
| 50423 | 4 | 9 | 10 | 9 | 2259.73 | 2246.28 | 9 | | | |
| 50423 | 5 | 111 | 10 | 10 | 2066.62 | 2050.05 | 10 | | | |
| 50423 | 6 | 51 | 10 | 9 | 2143.49 | 2125.5 | 9 | | | |
| 50423 | 7 | 76 | 10 | 10 | 2207.57 | 2195.3 | 7 | | | |
| 50423 | 8 | 67 | 10 | 9 | 2129.45 | 2121.78 | 3 | | | |
| 50424 | 1 | 33 | 10 | 9 | 2190.71 | 2178.87 | 7 | | | |
| 50424 | 2 | 156 | 10 | 8 | 2174.42 | 2161.76 | 7 | | | |
| 50424 | 3 | 168 | 10 | 10 | 2108.99 | 2096.47 | 9 | | | |
| 50424 | 4 | 30 | 10 | 9 | 2449.83 | 2438.53 | 7 | | | |
| 50424 | 5 | 86 | 10 | 7 | 2267.91 | 2258.05 | 5 | | | |
| 50424 | 6 | 65 | 10 | 9 | 2081.98 | 2071.02 | 6 | | | |
| 50424 | 7 | 92 | 10 | 8 | 2261.58 | 2248.59 | 7 | | | |
| 50424 | 8 | 14 | 10 | 10 | 2228.99 | 2212.83 | 10 | | | |
| 50425 | 1 | 150 | 10 | 9 | 2119.13 | 2106.53 | 7 | | | |
| 50425 | 2 | 71 | 10 | 10 | 2240.25 | 2227.55 | 7 | | | |
| 50425 | 3 | 53 | 10 | 9 | 2214.27 | 2202.56 | 7 | | | |
| 50425 | 4 | 104 | 10 | 8 | 2139.09 | 2126.93 | 6 | | | |
| 50425 | 5 | 11 | 10 | 9 | 2309.43 | 2295.66 | 8 | | | |
| 50425 | 6 | 114 | 10 | 9 | 2227.23 | 2215.05 | 7 | | | |
| 50425 | 7 | 36 | 10 | 7 | 2164.29 | 2159.13 | 2 | | | |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 107 | 10 | 10 | 2163.2 | 2149.99 | 8 | | | |
| 50426 | 1 | 151 | 10 | 9 | 2226.31 | 2213.52 | 8 | | | |
| 50426 | 2 | 122 | 10 | 7 | 2354.81 | 2340.68 | 7 | | | |
| 50426 | 3 | 112 | 10 | 9 | 2231.22 | 2218.04 | 8 | | | |
| 50426 | 4 | 139 | 10 | 8 | 2444.87 | 2433.46 | 6 | | | |
| 50426 | 5 | 72 | 10 | 7 | 2390.31 | 2379.17 | 5 | | | |
| 50426 | 6 | 101 | 10 | 7 | 2362.15 | 2350.34 | 6 | | | |
| 50426 | 7 | 48 | 10 | 10 | 2343.96 | 2331.77 | 9 | | | |
| 50426 | 8 | 103 | 10 | 9 | 2407.34 | 2396.27 | 7 | | | |
| 50427 | 1 | 138 | 10 | 8 | 2476.02 | 2467.02 | 4 | | | |
| 50427 | 2 | 97 | 10 | 6 | 2366.13 | 2356.99 | 4 | | | |
| 50427 | 3 | 77 | 10 | 8 | 2428.5 | 2413.79 | 7 | | | |
| 50427 | 4 | 152 | 10 | 9 | 2373.14 | 2360.36 | 6 | | | |
| 50427 | 5 | 40 | 10 | 10 | 2343.17 | 2325.07 | 10 | | | |
| 50427 | 6 | 126 | 10 | 10 | 2273.99 | 2261.18 | 8 | | | |
| 50427 | 7 | 83 | 10 | 7 | 2364.6 | 2355.23 | 5 | | | |
| 50427 | 8 | 54 | 10 | 10 | 2223.49 | 2210.73 | 8 | | | |
| 50428 | 1 | 43 | 10 | 10 | 2391.69 | 2377.49 | 8 | | | |
| 50428 | 2 | 23 | 10 | 8 | 2155.16 | 2142.61 | 6 | | | |
| 50428 | 3 | 166 | 10 | 10 | 2183.72 | 2168.43 | 9 | | | |
| 50428 | 4 | 91 | 10 | 8 | 2274.73 | 2264.08 | 6 | | | |
| 50428 | 5 | 37 | 10 | 8 | 2493.86 | 2484.17 | 5 | | | |
| 50428 | 6 | 64 | 10 | 8 | 2350.13 | 2334.55 | 8 | | | |
| 50428 | 7 | 147 | 10 | 8 | 2337.99 | 2323.78 | 7 | | | |
| 50428 | 8 | 123 | 10 | 10 | 2189.29 | 2171.95 | 10 | | | |
| 50429 | 1 | 163 | 10 | 9 | 2281.62 | 2266.05 | 8 | | | |
| 50429 | 2 | 98 | 10 | 9 | 2443.35 | 2429.48 | 7 | | | |
| 50429 | 3 | 31 | 10 | 8 | 2242.71 | 2230.96 | 6 | | | |
| 50429 | 4 | 110 | 10 | 10 | 2247.5 | 2229.58 | 10 | | | |
| 50429 | 5 | 102 | 10 | 10 | 2390.01 | 2374.08 | 9 | | | |
| 50429 | 6 | 164 | 10 | 7 | 2362.13 | 2353.08 | 5 | | | |
| 50429 | 7 | 82 | 10 | 8 | 2413.47 | 2404.32 | 5 | | | |
| 50429 | 8 | 49 | 10 | 10 | 2306.54 | 2290.94 | 8 | | | |
| 50430 | 1 | 63 | 10 | 8 | 2415.69 | 2400.62 | 5 | | | |
| 50430 | 2 | 70 | 10 | 8 | 2451.81 | 2437.21 | 6 | | | |
| 50430 | 3 | 137 | 10 | 7 | 2344.06 | 2330.84 | 6 | | | |
| 50430 | 4 | 80 | 10 | 9 | 2262.81 | 2246.15 | 8 | | | |
| 50430 | 5 | 50 | 10 | 7 | 2257.26 | 2244.85 | 5 | | | |
| 50430 | 6 | 116 | 10 | 9 | 2358.25 | 2341.15 | 8 | | | |
| 50430 | 7 | 84 | 10 | 10 | 2306.21 | 2286.87 | 8 | | | |
| 50430 | 8 | 45 | 10 | 9 | 2404.22 | 2388.88 | 7 | | | |
| 50431 | 1 | 19 | 10 | 8 | 2277.76 | 2268.9 | 5 | | | |
| 50431 | 2 | 96 | 10 | 9 | 2312.07 | 2302.4 | 6 | | | |
| 50431 | 3 | 25 | 10 | 10 | 2391.41 | 2378.81 | 7 | | | |
| 50431 | 4 | 60 | 10 | 9 | 2276.07 | 2261.25 | 9 | | | |
| 50431 | 5 | 159 | 10 | 9 | 2281.55 | 2266.02 | 8 | | | |
| 50431 | 6 | 149 | 10 | 9 | 2210.04 | 2196.37 | 8 | | | |
| 50431 | 7 | 21 | 10 | 10 | 2391.89 | 2372.46 | 10 | | | |
| 50431 | 8 | 8 | 10 | 8 | 2189.89 | 2179.92 | 5 | | | |
| 50432 | 1 | 18 | 10 | 9 | 2245.18 | 2229.04 | 8 | | | |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | 2 | 89 | 10 | 9 | 2439.27 | 2422.97 | 8 | | | |
| 50432 | 3 | 94 | 10 | 10 | 2293.81 | 2281.66 | 8 | | | |
| 50432 | 4 | 59 | 10 | 8 | 2418.58 | 2408.08 | 5 | | | |
| 50432 | 5 | 2 | 10 | 8 | 2292.05 | 2277.99 | 6 | | | |
| 50432 | 6 | 132 | 10 | 10 | 2370.38 | 2356.47 | 8 | | | |
| 50432 | 7 | 22 | 10 | 7 | 2357.78 | 2348.04 | 4 | | | |
| 50432 | 8 | 57 | 10 | 8 | 2446.1 | 2435.04 | 5 | | | |
| 50433 | 1 | 120 | 10 | 11 | 2359.92 | 2342.43 | 9 | | | |
| 50433 | 2 | 125 | 10 | 11 | 2313.94 | 2302.56 | 8 | | | |
| 50433 | 3 | 12 | 10 | 10 | 2350.41 | 2336.94 | 8 | | | |
| 50433 | 4 | 46 | 10 | 10 | 2307.9 | 2290.11 | 9 | | | |
| 50433 | 5 | 78 | 10 | 9 | 2465.03 | 2449.19 | 9 | | | |
| 50433 | 6 | 142 | 10 | 9 | 2385.83 | 2372.71 | 8 | | | |
| 50433 | 7 | 5 | 10 | 8 | 2238.99 | 2229.54 | 4 | | | |
| 50433 | 8 | 90 | 10 | 6 | 2295.71 | 2282.95 | 5 | | | |
| 50434 | 1 | 1 | 10 | 9 | 2226.64 | 2210.34 | 8 | | | |
| 50434 | 2 | 81 | 10 | 9 | 2255.22 | 2240.17 | 8 | | | |
| 50434 | 3 | 68 | 10 | 9 | 2419.68 | 2407.59 | 6 | | | |
| 50434 | 4 | 129 | 10 | 7 | 2407.67 | 2399.66 | 3 | | | |
| 50434 | 5 | 69 | 10 | 9 | 2517.56 | 2500.62 | 8 | | | |
| 50434 | 6 | 95 | 10 | 9 | 2299.13 | 2286.26 | 7 | | | |
| 50434 | 7 | 155 | 10 | 10 | 2447.8 | 2430.66 | 9 | | | |
| 50434 | 8 | 99 | 10 | 6 | 2234.17 | 2220.74 | 6 | | | |

*Chironomus dilutus*

10-day survival and

growth test (ash-free dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1600N

(Aquatec Sample # 50430)

STATISTICAL COMPARISON TO 50430
(SED BACK 1600N)

# CETIS Summary Report


Test Code: 80702 (B) | 19-0973-1636

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 11-1986-8050 | **Test Type:** | Survival-AF Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 01 Aug-17 19:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 11 Aug-17 16:45 | **Species:** | Chironomus dilutus | **Brine:** | |
| **Duration:** | 9d 21h | **Source:** | Aquatic Biosystems, CO | **Age:** | |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 08-3698-9406 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 1.0E-04 | 50415 failed mean af weight-mg |
| 14-7541-7700 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 4.9E-05 | 50416 failed mean af weight-mg |
| 01-6156-6073 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 8.2E-07 | 50417 failed mean af weight-mg |
| 09-3295-8627 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 5.5E-04 | 50418 failed mean af weight-mg |
| 07-6541-3416 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 2.3E-05 | 50419 failed mean af weight-mg |
| 02-1546-3916 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.0035 | 50420 failed mean af weight-mg |
| 17-2414-8633 | Mean AF Weight-mg | Unequal Variance t Two-Sample Test | 3.6E-04 | 50421 failed mean af weight-mg |
| 03-3566-6535 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 3.0E-04 | 50422 failed mean af weight-mg |
| 00-6401-6010 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0095 | 50423 failed mean af weight-mg |
| 02-2475-1976 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 6.4E-05 | 50424 failed mean af weight-mg |
| 10-6420-1148 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.0035 | 50425 failed mean af weight-mg |
| 20-8954-5972 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 7.0E-04 | 50426 failed mean af weight-mg |
| 16-0244-9914 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0061 | 50427 failed mean af weight-mg |
| 15-0011-7990 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 4.4E-04 | 50428 failed mean af weight-mg |
| 15-9641-7436 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 7.8E-05 | 50429 failed mean af weight-mg |
| 01-0602-5387 | Survival Rate | Equal Variance t Two-Sample Test | 0.9138 | 50415 passed survival rate |
| 17-7113-9666 | Survival Rate | Equal Variance t Two-Sample Test | 0.5814 | 50416 passed survival rate |
| 18-1042-6444 | Survival Rate | Equal Variance t Two-Sample Test | 0.8286 | 50417 passed survival rate |
| 12-9838-7045 | Survival Rate | Equal Variance t Two-Sample Test | 0.7622 | 50418 passed survival rate |
| 11-3544-8296 | Survival Rate | Equal Variance t Two-Sample Test | 0.9516 | 50419 passed survival rate |
| 16-7419-9610 | Survival Rate | Equal Variance t Two-Sample Test | 0.8679 | 50420 passed survival rate |
| 09-4247-9872 | Survival Rate | Equal Variance t Two-Sample Test | 0.9696 | 50421 passed survival rate |
| 14-1646-2201 | Survival Rate | Equal Variance t Two-Sample Test | 0.9516 | 50422 passed survival rate |
| 15-3428-6923 | Survival Rate | Equal Variance t Two-Sample Test | 0.7603 | 50423 passed survival rate |
| 13-9146-2149 | Survival Rate | Equal Variance t Two-Sample Test | 0.7568 | 50424 passed survival rate |
| 06-3005-1813 | Survival Rate | Equal Variance t Two-Sample Test | 0.8283 | 50425 passed survival rate |
| 03-8718-8851 | Survival Rate | Equal Variance t Two-Sample Test | 0.4258 | 50426 passed survival rate |
| 18-2142-6803 | Survival Rate | Equal Variance t Two-Sample Test | 0.6192 | 50427 passed survival rate |
| 16-5268-3952 | Survival Rate | Equal Variance t Two-Sample Test | 0.7475 | 50428 passed survival rate |
| 11-4413-5514 | Survival Rate | Equal Variance t Two-Sample Test | 0.8192 | 50429 passed survival rate |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

### Mean AF Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.083 | 3.014 | 0.1061 | 0.3 | 12.66% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.38 | 2.088 | 0.06959 | 0.1968 | 11.32% | 26.66% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.544 | 1.921 | 0.05377 | 0.1521 | 8.79% | 26.99% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.156 | 1.712 | 0.06052 | 0.1712 | 12.15% | 40.56% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.641 | 2.186 | 0.06328 | 0.179 | 9.59% | 21.30% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.305 | 1.911 | 0.069 | 0.1952 | 11.92% | 30.93% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.647 | 2.493 | 0.09311 | 0.2634 | 13.88% | 19.97% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.681 | 1.941 | 0.02893 | 0.08183 | 4.58% | 24.65% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.599 | 2.031 | 0.05696 | 0.1611 | 8.76% | 22.40% |
| 50423 | | 8 | 1.934 | 1.636 | 2.232 | 1.494 | 2.557 | 0.126 | 0.3564 | 18.43% | 18.41% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.391 | 1.972 | 0.06438 | 0.1821 | 10.57% | 27.35% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.651 | 2.58 | 0.1087 | 0.3076 | 16.40% | 20.86% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.354 | 2.228 | 0.1016 | 0.2875 | 16.08% | 24.59% |
| 50427 | | 8 | 1.956 | 1.726 | 2.186 | 1.595 | 2.285 | 0.09731 | 0.2752 | 14.07% | 17.48% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.699 | 2.092 | 0.05194 | 0.1469 | 7.84% | 20.95% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.77 | 1.981 | 0.03076 | 0.08699 | 4.63% | 20.69% |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 0.8375 | 0.7488 | 0.9262 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 12.66% | 0.00% |
| 50415 | | 8 | 0.9125 | 0.8184 | 1.0000 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.34% | -8.96% |
| 50416 | | 8 | 0.8500 | 0.7726 | 0.9274 | 0.7000 | 1.0000 | 0.0327 | 0.0926 | 10.89% | -1.49% |
| 50417 | | 8 | 0.8875 | 0.8177 | 0.9573 | 0.8000 | 1.0000 | 0.0295 | 0.0835 | 9.40% | -5.97% |
| 50418 | | 8 | 0.8750 | 0.8159 | 0.9341 | 0.8000 | 1.0000 | 0.0250 | 0.0707 | 8.08% | -4.48% |
| 50419 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -10.45% |
| 50420 | | 8 | 0.9000 | 0.8001 | 0.9999 | 0.7000 | 1.0000 | 0.0423 | 0.1195 | 13.28% | -7.46% |
| 50421 | | 8 | 0.9375 | 0.8609 | 1.0000 | 0.8000 | 1.0000 | 0.0324 | 0.0916 | 9.77% | -11.94% |
| 50422 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -10.45% |
| 50423 | | 8 | 0.8750 | 0.7776 | 0.9724 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 13.31% | -4.48% |
| 50424 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.7000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | -4.48% |
| 50425 | | 8 | 0.8875 | 0.8046 | 0.9704 | 0.7000 | 1.0000 | 0.0350 | 0.0991 | 11.17% | -5.97% |
| 50426 | | 8 | 0.8250 | 0.7276 | 0.9224 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 14.12% | 1.49% |
| 50427 | | 8 | 0.8500 | 0.7236 | 0.9764 | 0.6000 | 1.0000 | 0.0535 | 0.1512 | 17.79% | -1.49% |
| 50428 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.8000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | -4.48% |
| 50429 | | 8 | 0.8875 | 0.7934 | 0.9816 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.69% | -5.97% |

## CETIS Analytical Report


Test Code: 80702 (B) | 19-0973-1636

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-3698-9406 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50415 | 05-7381-9684 | 07 Jun-17 10:00 | 15 Jun-17 16:35 | 55d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50415 | Sediment | PEPCO Benning Rd-Waterside In | SED6C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50415 failed mean af weight-mg | 9.43% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50415* | 4.982 | 1.761 | 0.223 | 14 | CDF | 1.0E-04 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.59769 | 1.59769 | 1 | 24.82 | 2.0E-04 | Significant Effect |
| Error | 0.901025 | 0.0643589 | 14 | | | |
| Total | 2.49872 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.323 | 8.885 | 0.2886 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9135 | 0.8408 | 0.1323 | Normal Distribution |

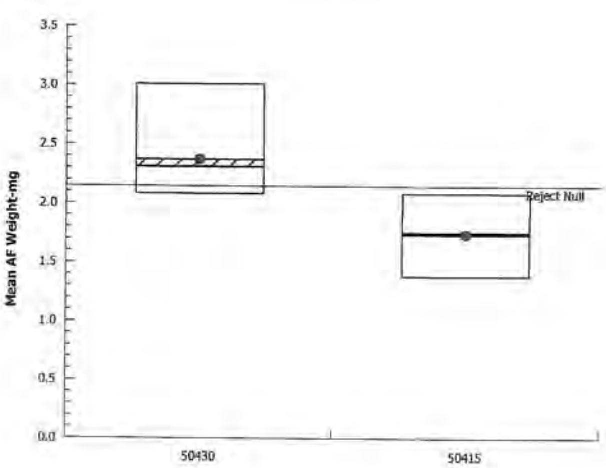
### Mean AF Weight-mg Summary

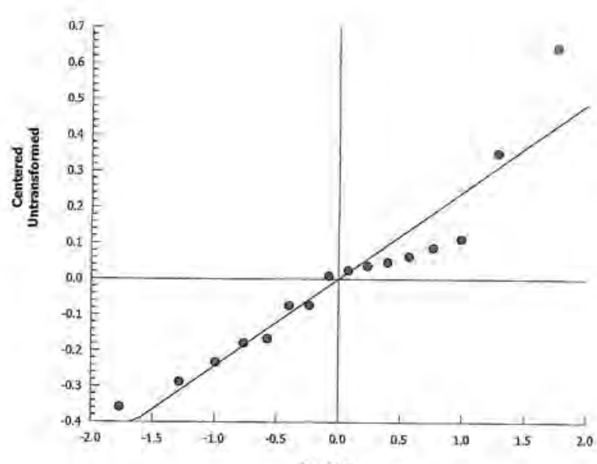
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.754 | 1.38 | 2.088 | 0.06959 | 11.32% | 26.66% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50415 | | 1.761 | 1.775 | 1.747 | 1.826 | 2.088 | 1.665 | 1.38 | 1.664 |

### Graphics





Analyst: [signature] QA: 9/10/17

## CETIS Analytical Report

Report Date: 08 Sep-17 14:23 (p 1 of 1)
Test Code: 80702 (B) | 19-0973-1636

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 14-7541-7700 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50416 | 17-8931-1896 | 07 Jun-17 11:30 | 15 Jun-17 16:35 | 55d 8h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50416 | Sediment | PEPCO Benning Rd-Waterside In | SED8C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50416 failed mean af weight-mg | 8.84% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50416* | 5.38 | 1.761 | 0.209 | 14 | CDF | 4.9E-05 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.63659 | 1.63659 | 1 | 28.94 | 9.7E-05 | Significant Effect |
| Error | 0.791739 | 0.0565528 | 14 | | | |
| Total | 2.42833 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.891 | 8.885 | 0.0937 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8832 | 0.8408 | 0.0435 | Normal Distribution |

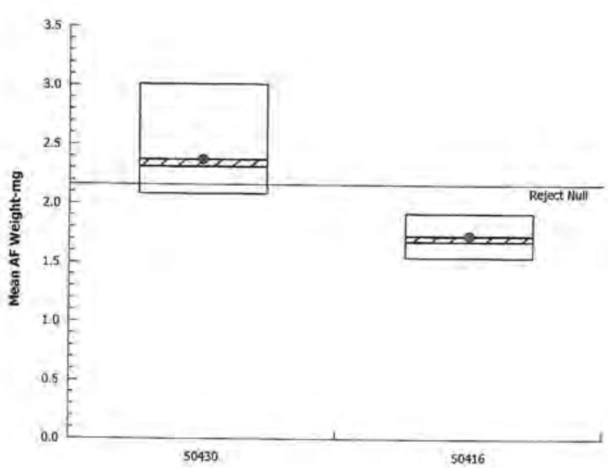
**Mean AF Weight-mg Summary**

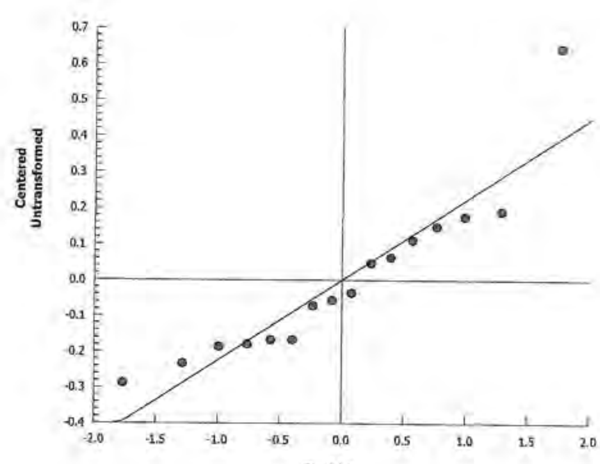
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.684 | 1.544 | 1.921 | 0.05377 | 8.79% | 26.99% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50416 | | 1.921 | 1.674 | 1.659 | 1.544 | 1.564 | 1.694 | 1.907 | 1.88 |

**Graphics**



## CETIS Analytical Report

| | | | |
|---|---|---|---|
| | | Report Date: | 08 Sep-17 14:22 (p 1 of 1) |
| | | Test Code: | 80702 (B) \| 19-0973-1636 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 01-6156-6073 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 55d 7h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean af weight-mg | 9.07% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 7.873 | 1.761 | 0.215 | 14 | CDF | 8.2E-07 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 3.69679 | 3.69679 | 1 | 61.98 | 1.6E-06 | Significant Effect |
| Error | 0.834999 | 0.0596428 | 14 | | | |
| Total | 4.53179 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.07 | 8.885 | 0.1620 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8906 | 0.8408 | 0.0570 | Normal Distribution |

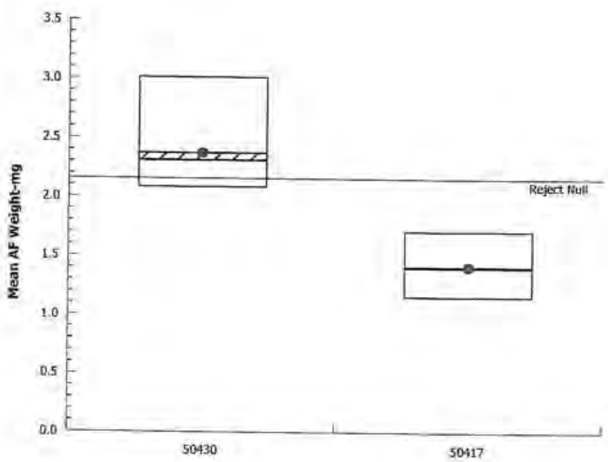
### Mean AF Weight-mg Summary

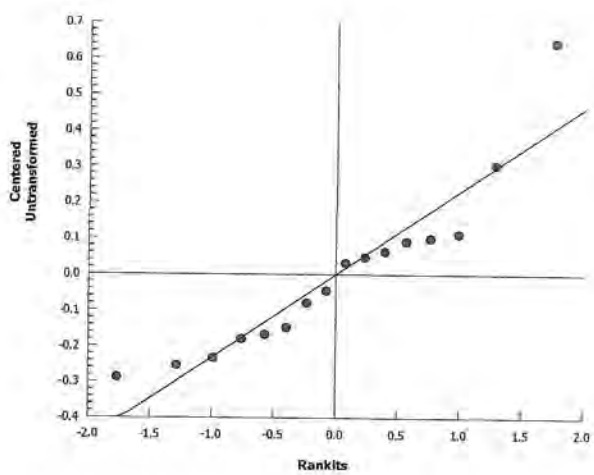
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.402 | 1.156 | 1.712 | 0.06052 | 12.15% | 40.56% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50417 | | 1.509 | 1.5 | 1.261 | 1.712 | 1.33 | 1.156 | 1.363 | 1.44 |

### Graphics



# CETIS Analytical Report

Report Date: 08 Sep-17 14:22 (p 1 of 1)
Test Code: 80702 (B) | 19-0973-1636

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| Analysis ID: | 09-3295-8627 | Endpoint: | Mean AF Weight-mg | CETIS Version: | CETISv1.9.2 |
|---|---|---|---|---|---|
| Analyzed: | 08 Sep-17 14:14 | Analysis: | Parametric-Two Sample | Official Results: | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50418 | 08-2555-0475 | 08 Jun-17 08:30 | 15 Jun-17 16:35 | 54d 11h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50418 | Sediment | PEPCO Benning Rd-Waterside In | SED7F00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50418 failed mean af weight-mg | 9.18% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50418* | 4.088 | 1.761 | 0.218 | 14 | CDF | 5.5E-04 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.01943 | 1.01943 | 1 | 16.71 | 0.0011 | Significant Effect |
| Error | 0.854089 | 0.0610064 | 14 | | | |
| Total | 1.87352 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.809 | 8.885 | 0.1964 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.881 | 0.8408 | 0.0402 | Normal Distribution |

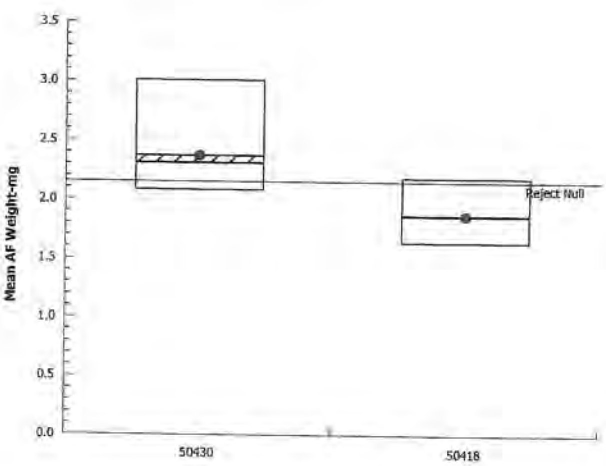
### Mean AF Weight-mg Summary

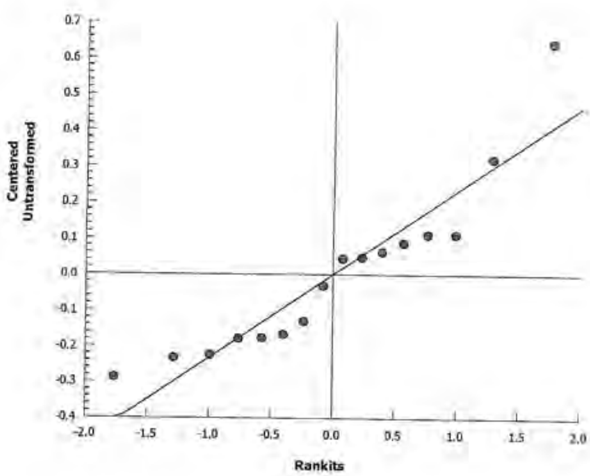
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.871 | 1.641 | 2.186 | 0.06328 | 9.59% | 21.30% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50418 | | 1.977 | 1.909 | 1.833 | 1.735 | 1.641 | 1.689 | 1.953 | 2.186 |

### Graphics



# CETIS Analytical Report

| Report Date: | 08 Sep-17 14:22 (p 1 of 1) |
|---|---|
| Test Code: | 80702 (B) \| 19-0973-1636 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 07-6541-3416 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 54d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean af weight-mg | 9.40% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50419* | 5.794 | 1.761 | 0.223 | 14 | CDF | 2.3E-05 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 2.14935 | 2.14935 | 1 | 33.57 | 4.7E-05 | Significant Effect |
| Error | 0.89648 | 0.0640343 | 14 | | | |
| Total | 3.04583 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.362 | 8.885 | 0.2793 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.919 | 0.8408 | 0.1627 | Normal Distribution |

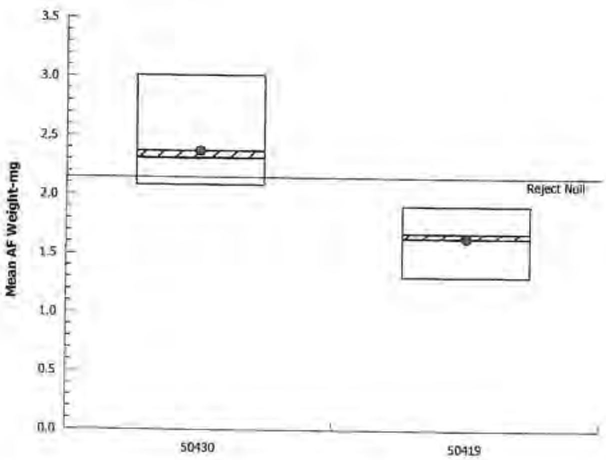
**Mean AF Weight-mg Summary**

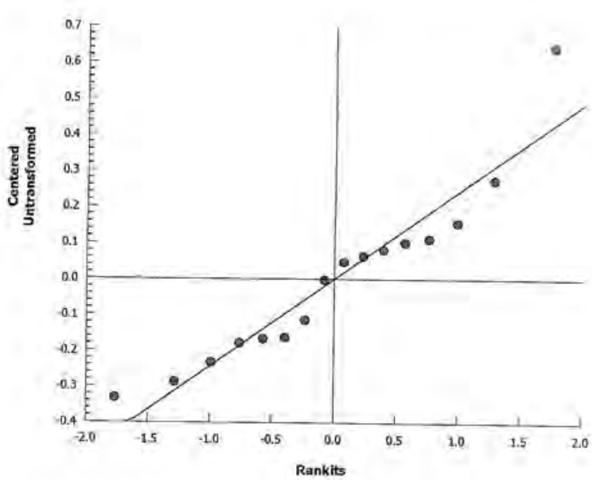
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.676 | 1.305 | 1.911 | 0.069 | 11.92% | 30.93% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50419 | | 1.474 | 1.634 | 1.793 | 1.911 | 1.305 | 1.719 | 1.522 | 1.738 |

**Graphics**



# CETIS Analytical Report

| | |
|---|---|
| **Report Date:** | 08 Sep-17 14:21 (p 1 of 1) |
| **Test Code:** | 80702 (B) \| 19-0973-1636 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 02-1546-3916 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Nonparametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50420 | 11-9421-7426 | 08 Jun-17 10:00 | 15 Jun-17 16:35 | 54d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50420 | Sediment | PEPCO Benning Rd-Waterside In | SED6.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50420 failed mean af weight-mg | 10.49% |

**Wilcoxon Rank Sum Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | Ties | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50420* | 43 | n/a | 0 | 14 | Exact | 0.0035 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.895853 | 0.895853 | 1 | 11.24 | 0.0047 | Significant Effect |
| Error | 1.11535 | 0.0796679 | 14 | | | |
| Total | 2.0112 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.297 | 8.885 | 0.7400 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8138 | 0.8408 | 0.0042 | Non-Normal Distribution |

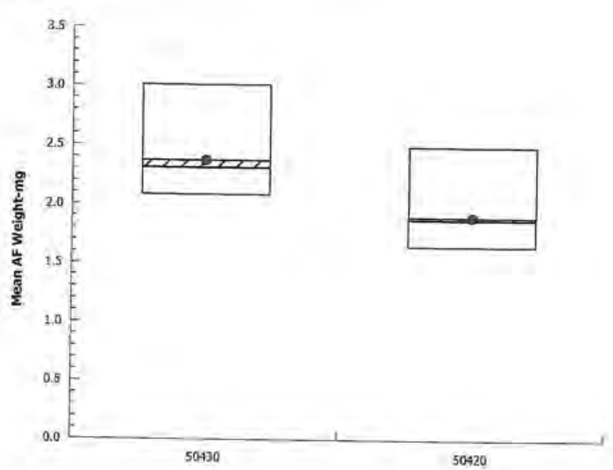
**Mean AF Weight-mg Summary**

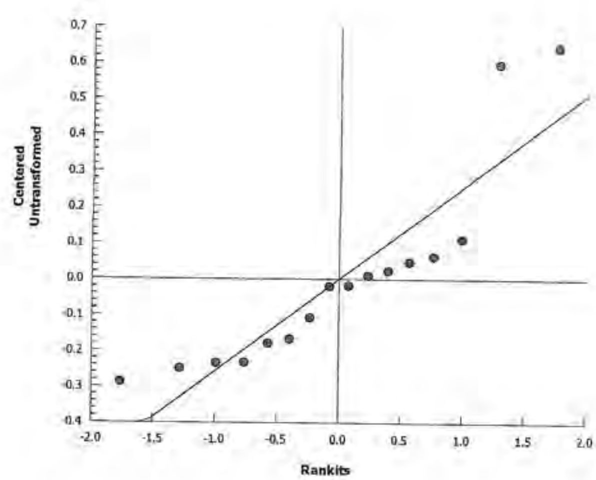
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.878 | 1.647 | 2.493 | 0.09311 | 13.88% | 19.97% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50420 | | 1.79 | 1.907 | 1.879 | 2.493 | 1.663 | 1.647 | 1.92 | 1.877 |

**Graphics**



# CETIS Analytical Report

Aquatec Environmental, Inc.

## Chironomus 10-d Survival and Growth Sediment Test

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 17-2414-8633 | Endpoint: | Mean AF Weight-mg | CETIS Version: | CETISv1.9.2 |
| Analyzed: | 08 Sep-17 14:14 | Analysis: | Parametric-Two Sample | Official Results: | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50421 | 10-8432-1021 | 08 Jun-17 10:30 | 15 Jun-17 16:35 | 54d 9h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50421 | Sediment | PEPCO Benning Rd-Waterside In | SED7E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50421 failed mean af weight-mg | 8.62% |

### Unequal Variance t Two-Sample Test

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Reference Sed | | 50421* | 5.315 | 1.86 | 0.204 | 8 | CDF | 3.6E-04 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.36528 | 1.36528 | 1 | 28.24 | 1.1E-04 | Significant Effect |
| Error | 0.676727 | 0.0483376 | 14 | | | |
| Total | 2.04201 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 13.44 | 8.885 | 0.0028 | Unequal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8417 | 0.8408 | 0.0103 | Normal Distribution |

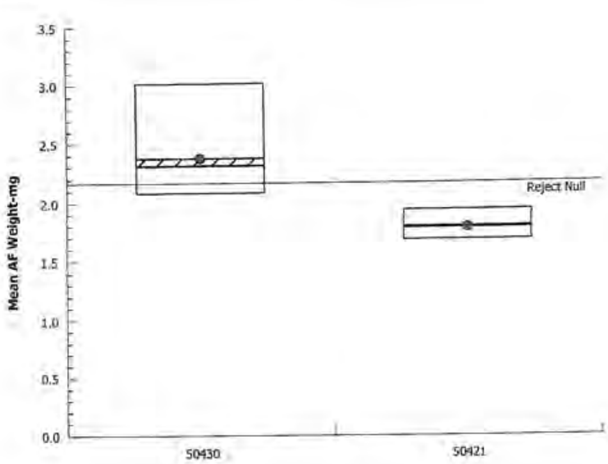
### Mean AF Weight-mg Summary

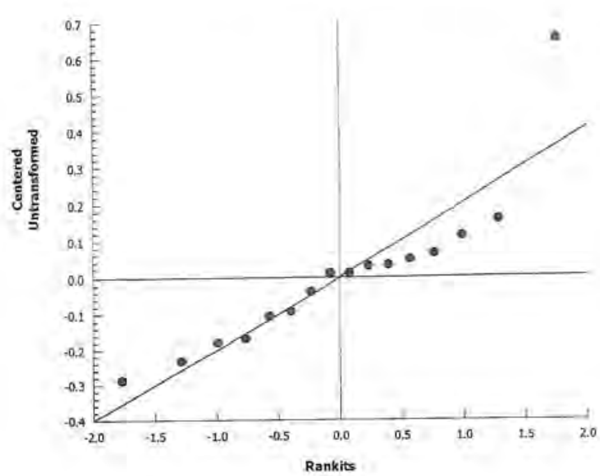
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.795 | 1.681 | 1.941 | 0.02893 | 4.58% | 24.65% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50421 | | 1.941 | 1.681 | 1.814 | 1.749 | 1.694 | 1.796 | 1.818 | 1.795 |

### Graphics






Analyst: [signature] QA: 9/15/[illegible]

# CETIS Analytical Report

| | | | |
|---|---|---|---|
| **Report Date:** | 08 Sep-17 14:22 (p 1 of 1) | | |
| **Test Code:** | 80702 (B) \| 19-0973-1636 | | |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 03-3566-6535 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50422 | 08-1584-0119 | 08 Jun-17 12:30 | 15 Jun-17 16:35 | 54d 7h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50422 | Sediment | PEPCO Benning Rd-Waterside In | SED6B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50422 failed mean af weight-mg | 8.95% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50422* | 4.411 | 1.761 | 0.212 | 14 | CDF | 3.0E-04 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.12781 | 1.12781 | 1 | 19.46 | 5.9E-04 | Significant Effect |
| Error | 0.811571 | 0.0579693 | 14 | | | |
| Total | 1.93938 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.466 | 8.885 | 0.1232 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8881 | 0.8408 | 0.0520 | Normal Distribution |

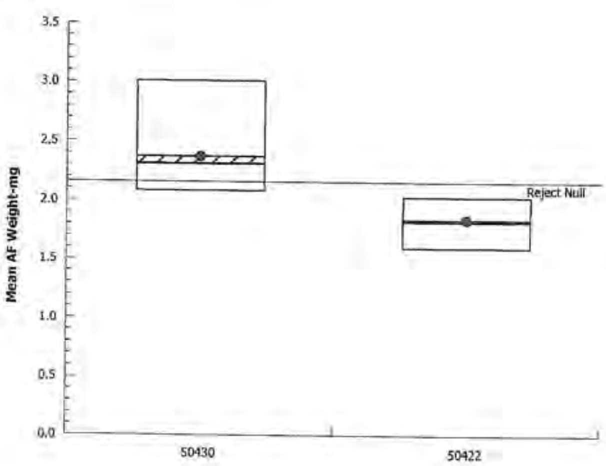
### Mean AF Weight-mg Summary

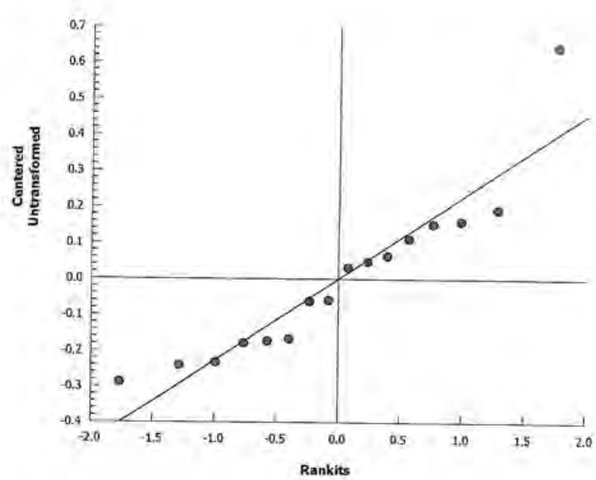
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.825 | 1.599 | 2.031 | 0.05696 | 8.76% | 22.40% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50422 | | 1.78 | 1.777 | 2.031 | 1.599 | 1.87 | 1.999 | 1.666 | 1.992 |

### Graphics



# CETIS Analytical Report

Report Date: 08 Sep-17 14:22 (p 1 of 1)
Test Code: 80702 (B) | 19-0973-1636

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 00-6401-6010 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50423 | 06-3488-3136 | 08 Jun-17 13:15 | 15 Jun-17 16:35 | 54d 6h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50423 | Sediment | PEPCO Benning Rd-Waterside In | SED6A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50423 failed mean af weight-mg | 12.24% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50423* | 2.649 | 1.761 | 0.290 | 14 | CDF | 0.0095 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.761463 | 0.761463 | 1 | 7.019 | 0.0191 | Significant Effect |
| Error | 1.51877 | 0.108483 | 14 | | | |
| Total | 2.28023 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.411 | 8.885 | 0.6608 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9061 | 0.8408 | 0.1008 | Normal Distribution |

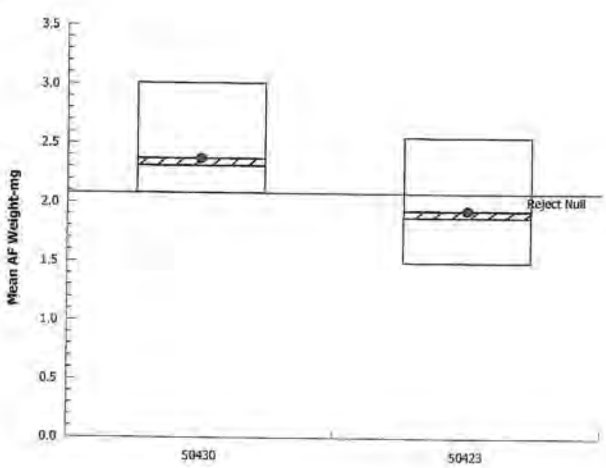
### Mean AF Weight-mg Summary

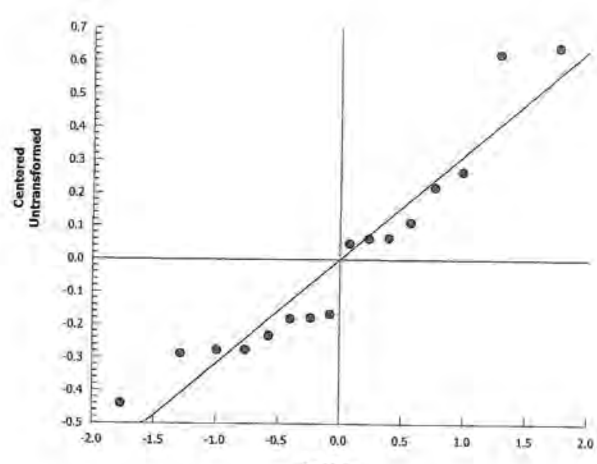
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50423 | | 8 | 1.934 | 1.636 | 2.232 | 1.876 | 1.494 | 2.557 | 0.126 | 18.43% | 18.41% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50423 | | 2.153 | 2.2 | 1.659 | 1.494 | 1.657 | 1.999 | 1.753 | 2.557 |

### Graphics



# CETIS Analytical Report

| | | | |
|---|---|---|---|
| **Report Date:** | 08 Sep-17 14:22 (p 1 of 1) | | |
| **Test Code:** | 80702 (B) \| 19-0973-1636 | | |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 02-2475-1976 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50424 | 00-7068-4401 | 09 Jun-17 08:15 | 15 Jun-17 16:35 | 53d 11h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50424 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50424 failed mean af weight-mg | 9.22% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50424* | 5.225 | 1.761 | 0.219 | 14 | CDF | 6.4E-05 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.68083 | 1.68083 | 1 | 27.3 | 1.3E-04 | Significant Effect |
| Error | 0.861929 | 0.0615663 | 14 | | | |
| Total | 2.54276 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.714 | 8.885 | 0.2111 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9166 | 0.8408 | 0.1486 | Normal Distribution |

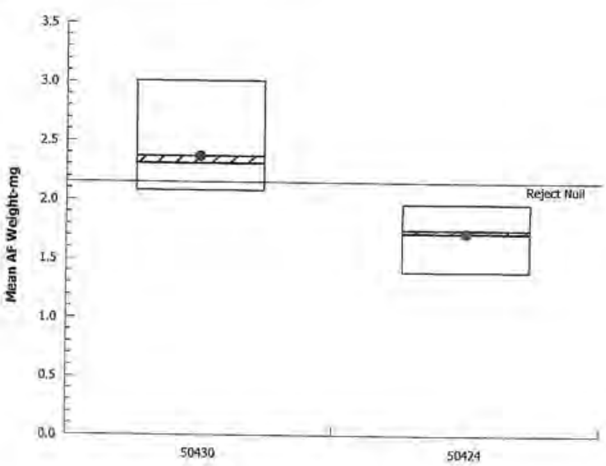
### Mean AF Weight-mg Summary

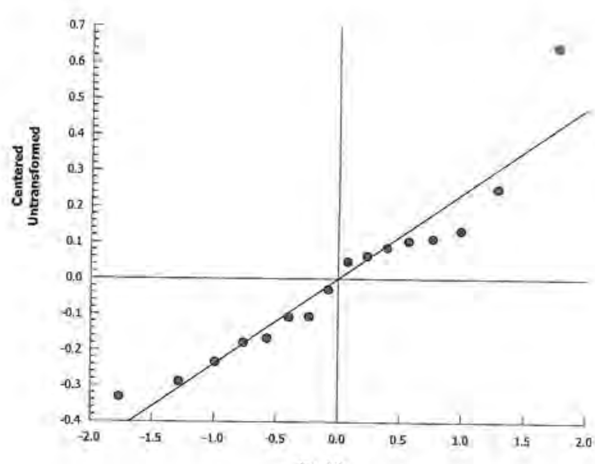
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.75 | 1.391 | 1.972 | 0.06438 | 10.57% | 27.35% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50424 | | 1.691 | 1.809 | 1.391 | 1.614 | 1.972 | 1.827 | 1.856 | 1.616 |

### Graphics



## CETIS Analytical Report

**Report Date:** 08 Sep-17 14:21 (p 1 of 1)
**Test Code:** 80702 (B) | 19-0973-1636

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 10-6420-1148 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Nonparametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50425 | 20-3042-7428 | 09 Jun-17 09:15 | 15 Jun-17 16:35 | 53d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50425 | Sediment | PEPCO Benning Rd-Waterside In | SED7D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50425 failed mean af weight-mg | 11.29% |

### Wilcoxon Rank Sum Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | Ties | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50425* | 43 | n/a | 0 | 14 | Exact | 0.0035 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.977731 | 0.977731 | 1 | 10.59 | 0.0058 | Significant Effect |
| Error | 1.29211 | 0.0922935 | 14 | | | |
| Total | 2.26984 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.051 | 8.885 | 0.9490 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.7879 | 0.8408 | 0.0019 | Non-Normal Distribution |

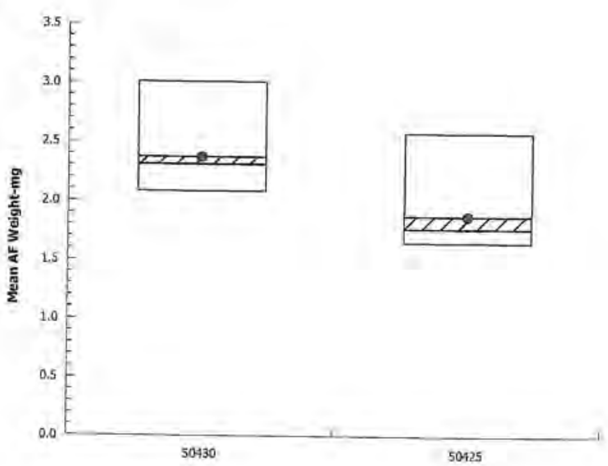
### Mean AF Weight-mg Summary

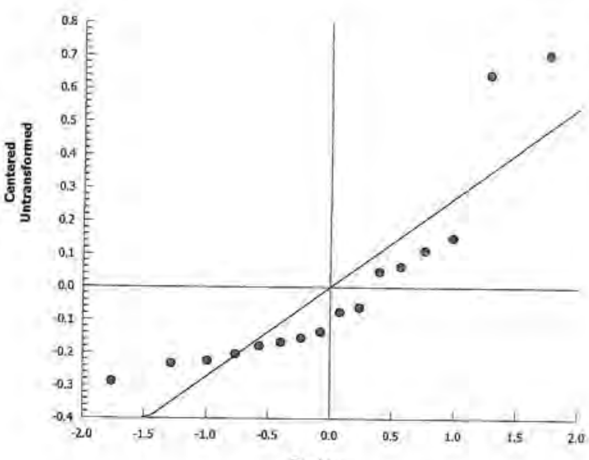
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.77 | 1.651 | 2.58 | 0.1087 | 16.40% | 20.86% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50425 | | 1.8 | 1.814 | 1.673 | 2.027 | 1.721 | 1.74 | 2.58 | 1.651 |

### Graphics



# CETIS Analytical Report

Report Date: 08 Sep-17 14:21 (p 1 of 1)
Test Code: 80702 (B) | 19-0973-1636

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 20-8954-5972 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50426 | 17-5556-0091 | 09 Jun-17 09:45 | 15 Jun-17 16:35 | 53d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50426 | Sediment | PEPCO Benning Rd-Waterside In | SED6.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50426 failed mean af weight-mg | 10.92% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50426* | 3.968 | 1.761 | 0.259 | 14 | CDF | 7.0E-04 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.35888 | 1.35888 | 1 | 15.74 | 0.0014 | Significant Effect |
| Error | 1.20828 | 0.086306 | 14 | | | |
| Total | 2.56717 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.089 | 8.885 | 0.9134 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9413 | 0.8408 | 0.3646 | Normal Distribution |

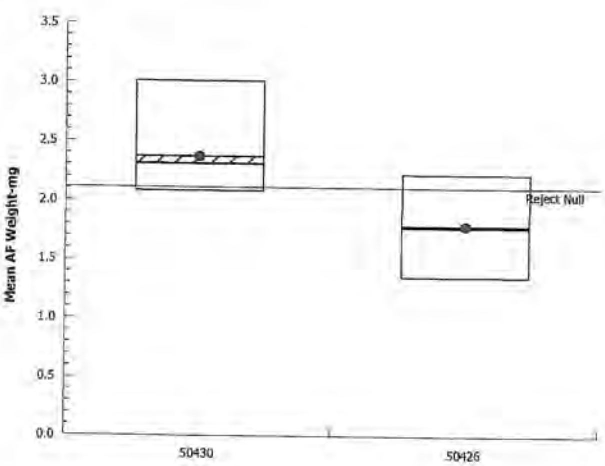
### Mean AF Weight-mg Summary

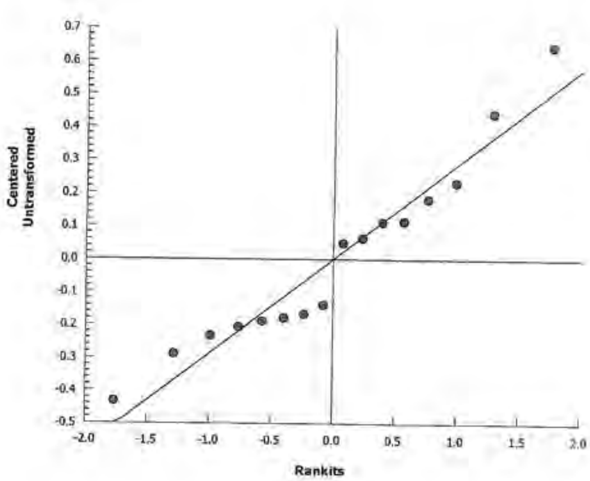
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.775 | 1.354 | 2.228 | 0.1016 | 16.08% | 24.59% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50426 | | 1.599 | 2.019 | 1.647 | 1.902 | 2.228 | 1.968 | 1.354 | 1.581 |

### Graphics



## CETIS Analytical Report

| Report Date: | 08 Sep-17 14:21 (p 1 of 1) |
|---|---|
| Test Code: | 80702 (B) \| 19-0973-1636 |

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| Analysis ID: | 16-0244-9914 | Endpoint: | Mean AF Weight-mg | CETIS Version: | CETISv1.9.2 |
| Analyzed: | 08 Sep-17 14:14 | Analysis: | Parametric-Two Sample | Official Results: | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50427 | 18-6592-9282 | 09 Jun-17 10:30 | 15 Jun-17 16:35 | 53d 9h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50427 | Sediment | PEPCO Benning Rd-Waterside In | SED8A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50427 failed mean af weight-mg | 10.70% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50427* | 2.879 | 1.761 | 0.254 | 14 | CDF | 0.0061 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.686806 | 0.686806 | 1 | 8.288 | 0.0121 | Significant Effect |
| Error | 1.16013 | 0.0828664 | 14 | | | |
| Total | 1.84694 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.188 | 8.885 | 0.8262 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9473 | 0.8408 | 0.4481 | Normal Distribution |

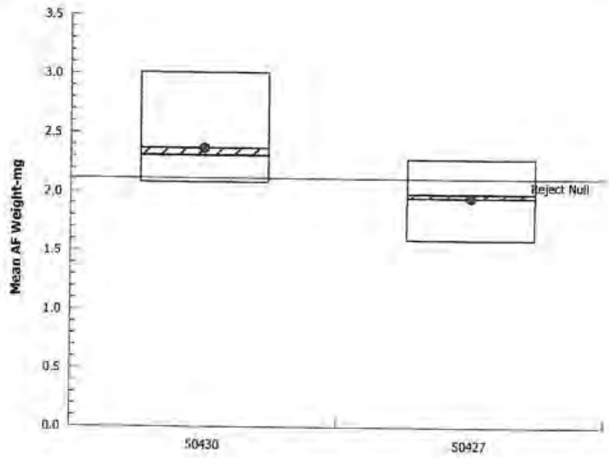
### Mean AF Weight-mg Summary

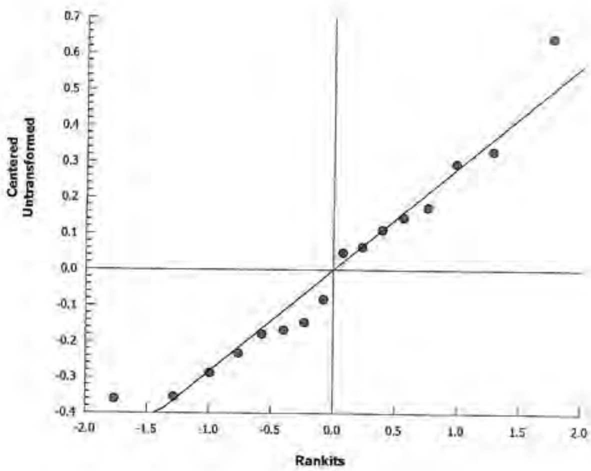
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50427 | | 8 | 1.956 | 1.726 | 2.186 | 1.988 | 1.595 | 2.285 | 0.09731 | 14.07% | 17.48% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50427 | | 2.25 | 2.285 | 2.101 | 2.13 | 1.81 | 1.601 | 1.874 | 1.595 |

### Graphics



**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 15-0011-7990 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50428 | 13-4023-9623 | 09 Jun-17 11:15 | 15 Jun-17 16:35 | 53d 8h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50428 | Sediment | PEPCO Benning Rd-Waterside In | SED7A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50428 failed mean af weight-mg | 8.78% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50428* | 4.204 | 1.761 | 0.208 | 14 | CDF | 4.4E-04 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.985828 | 0.985828 | 1 | 17.67 | 8.8E-04 | Significant Effect |
| Error | 0.780921 | 0.0557801 | 14 | | | |
| Total | 1.76675 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 4.169 | 8.885 | 0.0791 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8759 | 0.8408 | 0.0335 | Normal Distribution |

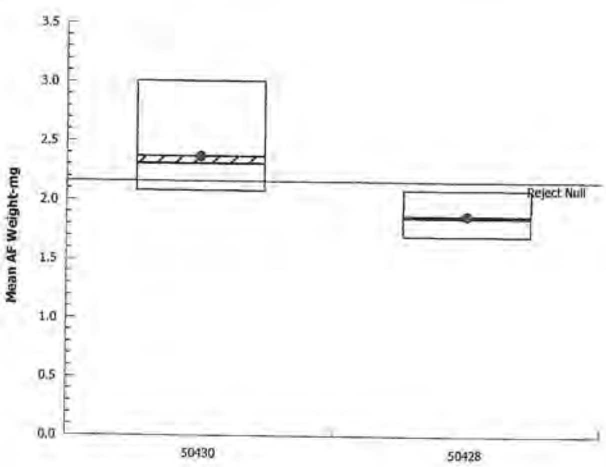
**Mean AF Weight-mg Summary**

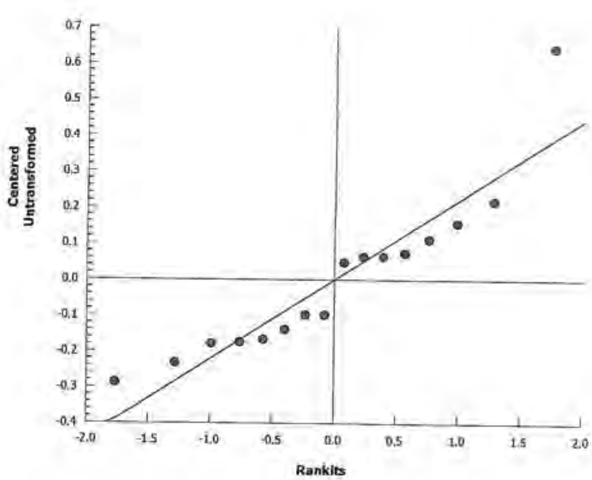
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.857 | 1.699 | 2.092 | 0.05194 | 7.84% | 20.95% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50428 | | 1.775 | 2.092 | 1.699 | 1.775 | 1.938 | 1.947 | 2.03 | 1.734 |

**Graphics**






Analyst: JV QA: 9/10/17

# CETIS Analytical Report

| | | | |
|---|---|---|---|
| **Report Date:** | 08 Sep-17 14:21 (p 1 of 1) | **Test Code:** | 80702 (B) \| 19-0973-1636 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 15-9641-7436 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:14 | **Analysis:** | Nonparametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 50d 9h | AECOM (MA) | Sediment Testing |
| 50429 | 15-9301-4614 | 09 Jun-17 12:00 | 15 Jun-17 16:35 | 53d 8h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |
| 50429 | Sediment | PEPCO Benning Rd-Waterside In | SED8B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50429 failed mean af weight-mg | 8.21% |

**Wilcoxon Rank Sum Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | Ties | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50429* | 36 | n/a | 0 | 14 | Exact | 7.8E-05 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.962166 | 0.962166 | 1 | 19.73 | 5.6E-04 | Significant Effect |
| Error | 0.68283 | 0.0487735 | 14 | | | |
| Total | 1.645 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 11.89 | 8.885 | 0.0041 | Unequal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8324 | 0.8408 | 0.0076 | Non-Normal Distribution |

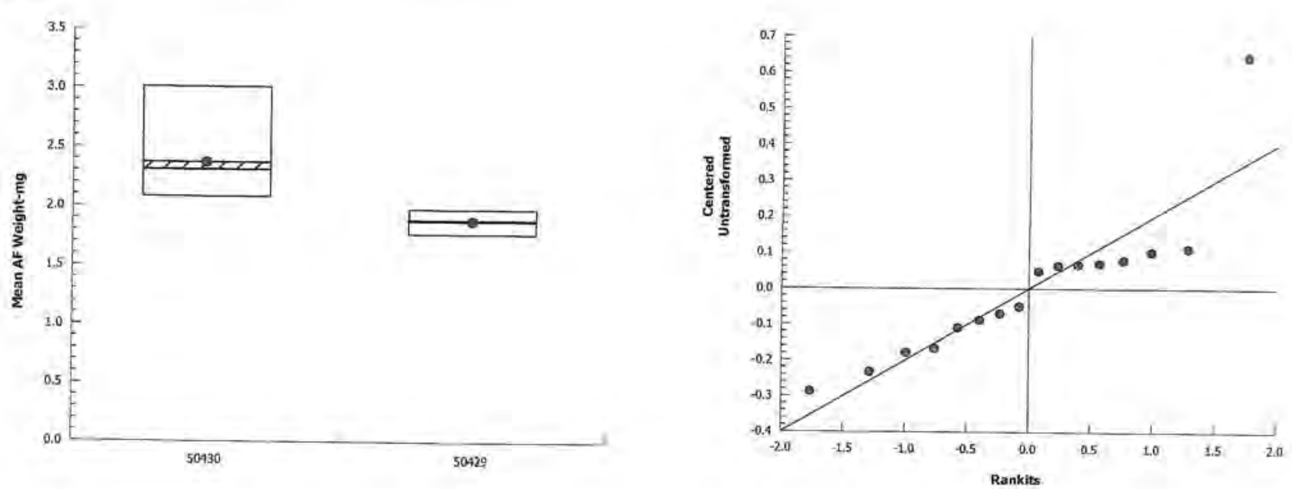
**Mean AF Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 2.37 | 2.119 | 2.621 | 2.31 | 2.083 | 3.014 | 0.1061 | 12.66% | 0.00% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.888 | 1.77 | 1.981 | 0.03076 | 4.63% | 20.69% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 3.014 | 2.433 | 2.203 | 2.083 | 2.482 | 2.138 | 2.417 | 2.191 |
| 50429 | | 1.946 | 1.981 | 1.958 | 1.792 | 1.77 | 1.81 | 1.83 | 1.95 |

**Graphics**



## CETIS Test Data Worksheet

Report Date: 08 Sep-17 14:13 (p 1 of 3)
Test Code/ID: 19-0973-1636/80702 (B)

**Chironomus 10-d Survival and Growth Sediment Test**

**Aquatec Environmental, Inc.**

**Start Date:** 01 Aug-17 19:30 **Species:** Chironomus dilutus **Sample Code:** 50430
**End Date:** 11 Aug-17 16:45 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** PEPCO Benning Rd-Waterside Inve
**Sample Date:** 12 Jun-17 10:15 **Material:** Reference sediment **Sample Station:** SEDBACK1600N

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | 1 | 29 | 10 | 8 | 2415.69 | 2400.62 | 5 | | | |
| 50430 | 2 | 102 | 10 | 8 | 2451.81 | 2437.21 | 6 | | | |
| 50430 | 3 | 6 | 10 | 7 | 2344.06 | 2330.84 | 6 | | | |
| 50430 | 4 | 55 | 10 | 9 | 2262.81 | 2246.15 | 8 | | | |
| 50430 | 5 | 83 | 10 | 7 | 2257.26 | 2244.85 | 5 | | | |
| 50430 | 6 | 80 | 10 | 9 | 2358.25 | 2341.15 | 8 | | | |
| 50430 | 7 | 8 | 10 | 10 | 2306.21 | 2286.87 | 8 | | | |
| 50430 | 8 | 5 | 10 | 9 | 2404.22 | 2388.88 | 7 | | | |
| 50415 | 1 | 32 | 10 | 9 | 2299.25 | 2286.92 | 7 | | | |
| 50415 | 2 | 103 | 10 | 9 | 2339.95 | 2325.75 | 8 | | | |
| 50415 | 3 | 66 | 10 | 10 | 2295.3 | 2284.82 | 6 | | | |
| 50415 | 4 | 120 | 10 | 8 | 2405.82 | 2393.04 | 7 | | | |
| 50415 | 5 | 18 | 10 | 7 | 2498.95 | 2488.51 | 5 | | | |
| 50415 | 6 | 65 | 10 | 10 | 2278.14 | 2268.15 | 6 | | | |
| 50415 | 7 | 77 | 10 | 10 | 2397.55 | 2387.89 | 7 | | | |
| 50415 | 8 | 67 | 10 | 10 | 2444.03 | 2430.72 | 8 | | | |
| 50416 | 1 | 10 | 10 | 8 | 2462.55 | 2449.1 | 7 | | | |
| 50416 | 2 | 11 | 10 | 10 | 2324.27 | 2307.53 | 10 | | | |
| 50416 | 3 | 87 | 10 | 9 | 2399.91 | 2384.98 | 9 | | | |
| 50416 | 4 | 22 | 10 | 9 | 2398.18 | 2384.28 | 9 | | | |
| 50416 | 5 | 84 | 10 | 8 | 2231.44 | 2220.49 | 7 | | | |
| 50416 | 6 | 106 | 10 | 9 | 2437.69 | 2425.83 | 7 | | | |
| 50416 | 7 | 58 | 10 | 7 | 2322.69 | 2309.34 | 7 | | | |
| 50416 | 8 | 71 | 10 | 8 | 2316.59 | 2305.31 | 6 | | | |
| 50417 | 1 | 101 | 10 | 8 | 2178.96 | 2166.89 | 8 | | | |
| 50417 | 2 | 114 | 10 | 9 | 2164.7 | 2152.7 | 8 | | | |
| 50417 | 3 | 79 | 10 | 9 | 2115.26 | 2106.43 | 7 | | | |
| 50417 | 4 | 56 | 10 | 8 | 2199.69 | 2189.42 | 6 | | | |
| 50417 | 5 | 110 | 10 | 10 | 2266.87 | 2253.57 | 10 | | | |
| 50417 | 6 | 15 | 10 | 10 | 2153.9 | 2143.5 | 9 | | | |
| 50417 | 7 | 51 | 10 | 9 | 2047.12 | 2034.85 | 9 | | | |
| 50417 | 8 | 89 | 10 | 8 | 2179.02 | 2168.94 | 7 | | | |
| 50418 | 1 | 64 | 10 | 8 | 2172.05 | 2160.19 | 6 | | | |
| 50418 | 2 | 111 | 10 | 8 | 2198.71 | 2185.35 | 7 | | | |
| 50418 | 3 | 36 | 10 | 9 | 2078.14 | 2061.64 | 9 | | | |
| 50418 | 4 | 85 | 10 | 9 | 2208 | 2197.59 | 6 | | | |
| 50418 | 5 | 60 | 10 | 9 | 2128.59 | 2115.46 | 8 | | | |
| 50418 | 6 | 121 | 10 | 10 | 2211.14 | 2197.63 | 8 | | | |
| 50418 | 7 | 119 | 10 | 9 | 2226.28 | 2208.7 | 9 | | | |
| 50418 | 8 | 34 | 10 | 8 | 2232.01 | 2221.08 | 5 | | | |
| 50419 | 1 | 94 | 10 | 10 | 2137.6 | 2122.86 | 10 | | | |
| 50419 | 2 | 92 | 10 | 10 | 2075.08 | 2058.74 | 10 | | | |
| 50419 | 3 | 23 | 10 | 9 | 2203.29 | 2187.15 | 9 | | | |
| 50419 | 4 | 96 | 10 | 8 | 2156.5 | 2143.12 | 7 | | | |
| 50419 | 5 | 105 | 10 | 10 | 2220.4 | 2207.35 | 10 | | | |

# CETIS Test Data Worksheet



| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 69 | 10 | 9 | 2207.66 | 2193.91 | 8 | | | |
| 50419 | 7 | 100 | 10 | 10 | 2197.41 | 2185.23 | 8 | | | |
| 50419 | 8 | 124 | 10 | 8 | 2235.22 | 2224.79 | 6 | | | |
| 50420 | 1 | 109 | 10 | 10 | 2198.79 | 2180.89 | 10 | | | |
| 50420 | 2 | 81 | 10 | 8 | 2222.76 | 2211.32 | 6 | | | |
| 50420 | 3 | 33 | 10 | 9 | 2180.75 | 2167.6 | 7 | | | |
| 50420 | 4 | 41 | 10 | 7 | 2474.78 | 2459.82 | 6 | | | |
| 50420 | 5 | 24 | 10 | 10 | 2157.79 | 2146.15 | 7 | | | |
| 50420 | 6 | 75 | 10 | 10 | 2124.4 | 2111.22 | 8 | | | |
| 50420 | 7 | 37 | 10 | 8 | 2127.79 | 2114.35 | 7 | | | |
| 50420 | 8 | 12 | 10 | 10 | 2134.34 | 2117.45 | 9 | | | |
| 50421 | 1 | 46 | 10 | 10 | 2039.98 | 2024.45 | 8 | | | |
| 50421 | 2 | 59 | 10 | 10 | 2243.29 | 2228.16 | 9 | | | |
| 50421 | 3 | 7 | 10 | 8 | 2191.22 | 2178.52 | 7 | | | |
| 50421 | 4 | 72 | 10 | 10 | 2128.78 | 2114.79 | 8 | | | |
| 50421 | 5 | 28 | 10 | 9 | 2140.17 | 2128.31 | 7 | | | |
| 50421 | 6 | 70 | 10 | 10 | 2120.11 | 2103.95 | 9 | | | |
| 50421 | 7 | 62 | 10 | 10 | 2199.8 | 2185.26 | 8 | | | |
| 50421 | 8 | 17 | 10 | 8 | 2219.81 | 2205.45 | 8 | | | |
| 50422 | 1 | 44 | 10 | 10 | 2161.55 | 2145.53 | 9 | | | |
| 50422 | 2 | 19 | 10 | 8 | 2297.93 | 2285.49 | 7 | | | |
| 50422 | 3 | 57 | 10 | 8 | 2083.43 | 2069.21 | 7 | | | |
| 50422 | 4 | 38 | 10 | 10 | 2035.97 | 2024.78 | 7 | | | |
| 50422 | 5 | 88 | 10 | 9 | 2208.11 | 2196.89 | 6 | | | |
| 50422 | 6 | 123 | 10 | 10 | 2214.72 | 2200.73 | 7 | | | |
| 50422 | 7 | 128 | 10 | 10 | 2162.86 | 2149.53 | 8 | | | |
| 50422 | 8 | 116 | 10 | 9 | 2321.46 | 2309.51 | 6 | | | |
| 50423 | 1 | 113 | 10 | 7 | 2544.52 | 2535.91 | 4 | | | |
| 50423 | 2 | 112 | 10 | 7 | 2219.01 | 2205.81 | 6 | | | |
| 50423 | 3 | 26 | 10 | 9 | 2204.08 | 2190.81 | 8 | | | |
| 50423 | 4 | 95 | 10 | 9 | 2259.73 | 2246.28 | 9 | | | |
| 50423 | 5 | 42 | 10 | 10 | 2066.62 | 2050.05 | 10 | | | |
| 50423 | 6 | 49 | 10 | 9 | 2143.49 | 2125.5 | 9 | | | |
| 50423 | 7 | 90 | 10 | 10 | 2207.57 | 2195.3 | 7 | | | |
| 50423 | 8 | 107 | 10 | 9 | 2129.45 | 2121.78 | 3 | | | |
| 50424 | 1 | 76 | 10 | 9 | 2190.71 | 2178.87 | 7 | | | |
| 50424 | 2 | 91 | 10 | 8 | 2174.42 | 2161.76 | 7 | | | |
| 50424 | 3 | 14 | 10 | 10 | 2108.99 | 2096.47 | 9 | | | |
| 50424 | 4 | 3 | 10 | 9 | 2449.83 | 2438.53 | 7 | | | |
| 50424 | 5 | 125 | 10 | 7 | 2267.91 | 2258.05 | 5 | | | |
| 50424 | 6 | 104 | 10 | 9 | 2081.98 | 2071.02 | 6 | | | |
| 50424 | 7 | 115 | 10 | 8 | 2261.58 | 2248.59 | 7 | | | |
| 50424 | 8 | 82 | 10 | 10 | 2228.99 | 2212.83 | 10 | | | |
| 50425 | 1 | 50 | 10 | 9 | 2119.13 | 2106.53 | 7 | | | |
| 50425 | 2 | 97 | 10 | 10 | 2240.25 | 2227.55 | 7 | | | |
| 50425 | 3 | 118 | 10 | 9 | 2214.27 | 2202.56 | 7 | | | |
| 50425 | 4 | 117 | 10 | 8 | 2139.09 | 2126.93 | 6 | | | |
| 50425 | 5 | 74 | 10 | 9 | 2309.43 | 2295.66 | 8 | | | |
| 50425 | 6 | 53 | 10 | 9 | 2227.23 | 2215.05 | 7 | | | |
| 50425 | 7 | 31 | 10 | 7 | 2164.29 | 2159.13 | 2 | | | |



Analyst: [signature] QA: 9/10/17

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 68 | 10 | 10 | 2163.2 | 2149.99 | 8 | | | |
| 50426 | 1 | 25 | 10 | 9 | 2226.31 | 2213.52 | 8 | | | |
| 50426 | 2 | 40 | 10 | 7 | 2354.81 | 2340.68 | 7 | | | |
| 50426 | 3 | 39 | 10 | 9 | 2231.22 | 2218.04 | 8 | | | |
| 50426 | 4 | 16 | 10 | 8 | 2444.87 | 2433.46 | 6 | | | |
| 50426 | 5 | 122 | 10 | 7 | 2390.31 | 2379.17 | 5 | | | |
| 50426 | 6 | 86 | 10 | 7 | 2362.15 | 2350.34 | 6 | | | |
| 50426 | 7 | 2 | 10 | 10 | 2343.96 | 2331.77 | 9 | | | |
| 50426 | 8 | 9 | 10 | 9 | 2407.34 | 2396.27 | 7 | | | |
| 50427 | 1 | 54 | 10 | 8 | 2476.02 | 2467.02 | 4 | | | |
| 50427 | 2 | 20 | 10 | 6 | 2366.13 | 2356.99 | 4 | | | |
| 50427 | 3 | 126 | 10 | 8 | 2428.5 | 2413.79 | 7 | | | |
| 50427 | 4 | 52 | 10 | 9 | 2373.14 | 2360.36 | 6 | | | |
| 50427 | 5 | 30 | 10 | 10 | 2343.17 | 2325.07 | 10 | | | |
| 50427 | 6 | 21 | 10 | 10 | 2273.99 | 2261.18 | 8 | | | |
| 50427 | 7 | 93 | 10 | 7 | 2364.6 | 2355.23 | 5 | | | |
| 50427 | 8 | 108 | 10 | 10 | 2223.49 | 2210.73 | 8 | | | |
| 50428 | 1 | 99 | 10 | 10 | 2391.69 | 2377.49 | 8 | | | |
| 50428 | 2 | 13 | 10 | 8 | 2155.16 | 2142.61 | 6 | | | |
| 50428 | 3 | 4 | 10 | 10 | 2183.72 | 2168.43 | 9 | | | |
| 50428 | 4 | 73 | 10 | 8 | 2274.73 | 2264.08 | 6 | | | |
| 50428 | 5 | 127 | 10 | 8 | 2493.86 | 2484.17 | 5 | | | |
| 50428 | 6 | 35 | 10 | 8 | 2350.13 | 2334.55 | 8 | | | |
| 50428 | 7 | 45 | 10 | 8 | 2337.99 | 2323.78 | 7 | | | |
| 50428 | 8 | 78 | 10 | 10 | 2189.29 | 2171.95 | 10 | | | |
| 50429 | 1 | 61 | 10 | 9 | 2281.62 | 2266.05 | 8 | | | |
| 50429 | 2 | 47 | 10 | 9 | 2443.35 | 2429.48 | 7 | | | |
| 50429 | 3 | 63 | 10 | 8 | 2242.71 | 2230.96 | 6 | | | |
| 50429 | 4 | 48 | 10 | 10 | 2247.5 | 2229.58 | 10 | | | |
| 50429 | 5 | 1 | 10 | 10 | 2390.01 | 2374.08 | 9 | | | |
| 50429 | 6 | 98 | 10 | 7 | 2362.13 | 2353.08 | 5 | | | |
| 50429 | 7 | 43 | 10 | 8 | 2413.47 | 2404.32 | 5 | | | |
| 50429 | 8 | 27 | 10 | 10 | 2306.54 | 2290.94 | 8 | | | |

*Chironomus dilutus*

10-day survival and

growth test (ash-free dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1700N

(Aquatec Sample # 50431)

STATISTICAL COMPARISONS TO 50431 (SEDBACK1700N)

# CETIS Summary Report

Report Date: 08 Sep-17 14:36 (p 1 of 2)
Test Code: 80703 (C) | 13-8139-4602

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 11-1986-8050 | **Test Type:** | Survival-AF Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 01 Aug-17 19:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 11 Aug-17 16:45 | **Species:** | Chironomus dilutus | **Brine:** | |
| **Duration:** | 9d 21h | **Source:** | Aquatic Biosystems, CO | **Age:** | |

## Single Comparison Summary

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 15-1769-8623 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.2354 | 50415 passed mean af weight-mg |
| 03-7830-4413 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1753 | 50416 passed mean af weight-mg |
| 05-7111-0837 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 1.0E-04 | 50417 failed mean af weight-mg |
| 17-3785-8882 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.7750 | 50418 passed mean af weight-mg |
| 12-8033-2575 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0376 | 50419 failed mean af weight-mg |
| 17-0250-5224 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.8064 | 50420 passed mean af weight-mg |
| 06-0882-9210 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.3933 | 50421 passed mean af weight-mg |
| 01-8328-2219 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.6821 | 50422 passed mean af weight-mg |
| 05-8084-6353 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.8255 | 50423 passed mean af weight-mg |
| 10-6326-6188 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1728 | 50424 passed mean af weight-mg |
| 09-8760-6294 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.6497 | 50425 passed mean af weight-mg |
| 20-6303-7169 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.4491 | 50426 passed mean af weight-mg |
| 07-6163-6882 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.9081 | 50427 passed mean af weight-mg |
| 15-7158-3392 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.8288 | 50428 passed mean af weight-mg |
| 15-5610-1587 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.8929 | 50429 passed mean af weight-mg |
| 16-3517-2741 | Survival Rate | Equal Variance t Two-Sample Test | 0.6424 | 50415 passed survival rate |
| 09-8997-8016 | Survival Rate | Equal Variance t Two-Sample Test | 0.1365 | 50416 passed survival rate |
| 01-7995-3624 | Survival Rate | Equal Variance t Two-Sample Test | 0.3870 | 50417 passed survival rate |
| 04-1646-5873 | Survival Rate | Equal Variance t Two-Sample Test | 0.2512 | 50418 passed survival rate |
| 09-0179-3489 | Survival Rate | Equal Variance t Two-Sample Test | 0.7356 | 50419 passed survival rate |
| 13-2884-0095 | Survival Rate | Equal Variance t Two-Sample Test | 0.5451 | 50420 passed survival rate |
| 11-9130-7492 | Survival Rate | Equal Variance t Two-Sample Test | 0.8213 | 50421 passed survival rate |
| 09-9715-4035 | Survival Rate | Equal Variance t Two-Sample Test | 0.7356 | 50422 passed survival rate |
| 11-0577-4189 | Survival Rate | Equal Variance t Two-Sample Test | 0.3426 | 50423 passed survival rate |
| 17-2910-3602 | Survival Rate | Equal Variance t Two-Sample Test | 0.3175 | 50424 passed survival rate |
| 20-4197-3491 | Survival Rate | Equal Variance t Two-Sample Test | 0.4126 | 50425 passed survival rate |
| 10-7186-9476 | Survival Rate | Equal Variance t Two-Sample Test | 0.0867 | 50426 passed survival rate |
| 14-8980-1846 | Survival Rate | Equal Variance t Two-Sample Test | 0.2519 | 50427 passed survival rate |
| 07-9968-5066 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.2145 | 50428 passed survival rate |
| 09-4695-0405 | Survival Rate | Equal Variance t Two-Sample Test | 0.4345 | 50429 passed survival rate |

Chironomus 10-d Survival and Growth Sediment Test — Aquatec Environmental, Inc.

### Mean AF Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 8 | 1.802 | 1.681 | 1.923 | 1.612 | 1.994 | 0.05107 | 0.1445 | 8.02% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.38 | 2.088 | 0.06959 | 0.1968 | 11.32% | 3.55% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.544 | 1.921 | 0.05377 | 0.1521 | 8.79% | 3.97% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.156 | 1.712 | 0.06052 | 0.1712 | 12.15% | 21.82% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.641 | 2.186 | 0.06328 | 0.179 | 9.59% | -3.51% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.305 | 1.911 | 0.069 | 0.1952 | 11.92% | 9.16% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.647 | 2.493 | 0.09311 | 0.2634 | 13.88% | -5.26% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.681 | 1.941 | 0.02893 | 0.08183 | 4.58% | 0.90% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.599 | 2.031 | 0.05696 | 0.1611 | 8.76% | -2.06% |
| 50423 | | 8 | 1.934 | 1.636 | 2.232 | 1.494 | 2.557 | 0.126 | 0.3564 | 18.43% | -7.31% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.391 | 1.972 | 0.06438 | 0.1821 | 10.57% | 4.45% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.651 | 2.58 | 0.1087 | 0.3076 | 16.40% | -4.09% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.354 | 2.228 | 0.1016 | 0.2875 | 16.08% | 0.82% |
| 50427 | | 8 | 1.956 | 1.726 | 2.186 | 1.595 | 2.285 | 0.09731 | 0.2752 | 14.07% | -8.53% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.699 | 2.092 | 0.05194 | 0.1469 | 7.84% | -3.97% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.77 | 1.981 | 0.03076 | 0.08699 | 4.63% | -4.30% |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | 0.00% |
| 50415 | | 8 | 0.9125 | 0.8184 | 1.0000 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.34% | -1.39% |
| 50416 | | 8 | 0.8500 | 0.7726 | 0.9274 | 0.7000 | 1.0000 | 0.0327 | 0.0926 | 10.89% | 5.56% |
| 50417 | | 8 | 0.8875 | 0.8177 | 0.9573 | 0.8000 | 1.0000 | 0.0295 | 0.0835 | 9.40% | 1.39% |
| 50418 | | 8 | 0.8750 | 0.8159 | 0.9341 | 0.8000 | 1.0000 | 0.0250 | 0.0707 | 8.08% | 2.78% |
| 50419 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -2.78% |
| 50420 | | 8 | 0.9000 | 0.8001 | 0.9999 | 0.7000 | 1.0000 | 0.0423 | 0.1195 | 13.28% | 0.00% |
| 50421 | | 8 | 0.9375 | 0.8609 | 1.0000 | 0.8000 | 1.0000 | 0.0324 | 0.0916 | 9.77% | -4.17% |
| 50422 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -2.78% |
| 50423 | | 8 | 0.8750 | 0.7776 | 0.9724 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 13.31% | 2.78% |
| 50424 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.7000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | 2.78% |
| 50425 | | 8 | 0.8875 | 0.8046 | 0.9704 | 0.7000 | 1.0000 | 0.0350 | 0.0991 | 11.17% | 1.39% |
| 50426 | | 8 | 0.8250 | 0.7276 | 0.9224 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 14.12% | 8.33% |
| 50427 | | 8 | 0.8500 | 0.7236 | 0.9764 | 0.6000 | 1.0000 | 0.0535 | 0.1512 | 17.79% | 5.56% |
| 50428 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.8000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | 2.78% |
| 50429 | | 8 | 0.8875 | 0.7934 | 0.9816 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.69% | 1.39% |

# CETIS Analytical Report

Report Date: 08 Sep-17 14:37 (p 1 of 1)
Test Code: 80703 (C) | 13-8139-4602

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 05-7111-0837 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:35 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50431 | 12-3900-0842 | 12 Jun-17 12:00 | 15 Jun-17 16:35 | 50d 8h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 55d 7h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50431 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1700N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean af weight-mg | 7.74% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 4.967 | 1.761 | 0.14 | 14 | CDF | 1.0E-04 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.618813 | 0.618813 | 1 | 24.67 | 2.1E-04 | Significant Effect |
| Error | 0.351217 | 0.0250869 | 14 | | | |
| Total | 0.97003 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.404 | 8.885 | 0.6654 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9824 | 0.8408 | 0.9797 | Normal Distribution |

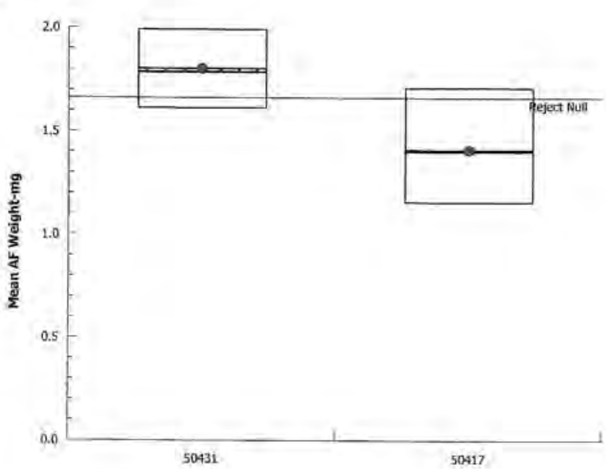
**Mean AF Weight-mg Summary**

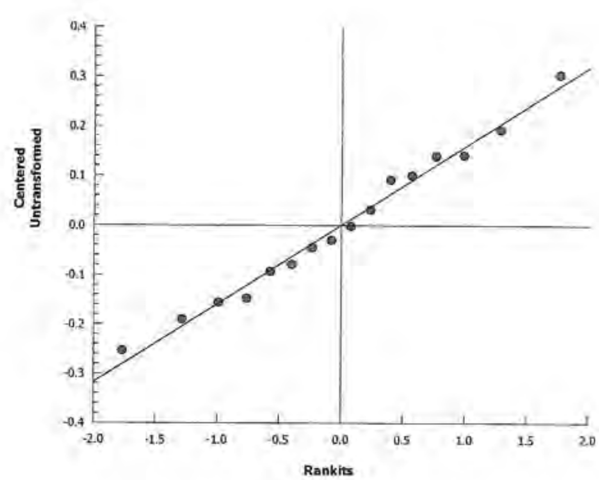
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 8 | 1.802 | 1.681 | 1.923 | 1.786 | 1.612 | 1.994 | 0.05107 | 8.02% | 0.00% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.402 | 1.156 | 1.712 | 0.06052 | 12.15% | 21.82% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 1.772 | 1.612 | 1.8 | 1.647 | 1.941 | 1.709 | 1.943 | 1.994 |
| 50417 | | 1.509 | 1.5 | 1.261 | 1.712 | 1.33 | 1.156 | 1.363 | 1.44 |

**Graphics**



# CETIS Analytical Report

| | |
|---|---|
| Report Date: | 08 Sep-17 14:37 (p 1 of 1) |
| Test Code: | 80703 (C) \| 13-8139-4602 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 12-8033-2575 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 14:35 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50431 | 12-3900-0842 | 12 Jun-17 12:00 | 15 Jun-17 16:35 | 50d 8h | AECOM (MA) | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 54d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50431 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1700N | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean af weight-mg | 8.39% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50419* | 1.922 | 1.761 | 0.151 | 14 | CDF | 0.0376 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.108906 | 0.108906 | 1 | 3.694 | 0.0752 | Non-Significant Effect |
| Error | 0.412698 | 0.0294784 | 14 | | | |
| Total | 0.521604 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.825 | 8.885 | 0.4456 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9718 | 0.8408 | 0.8674 | Normal Distribution |

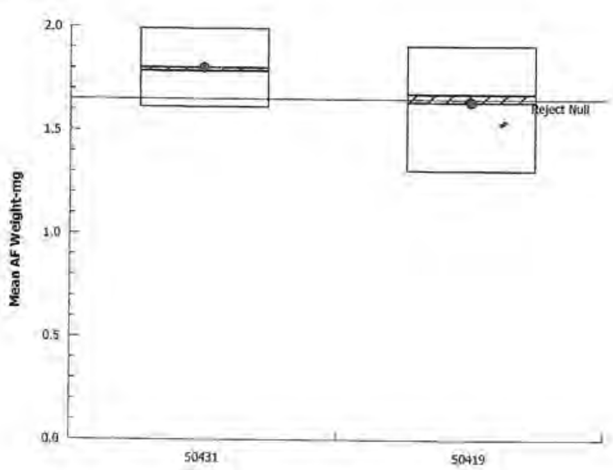
**Mean AF Weight-mg Summary**

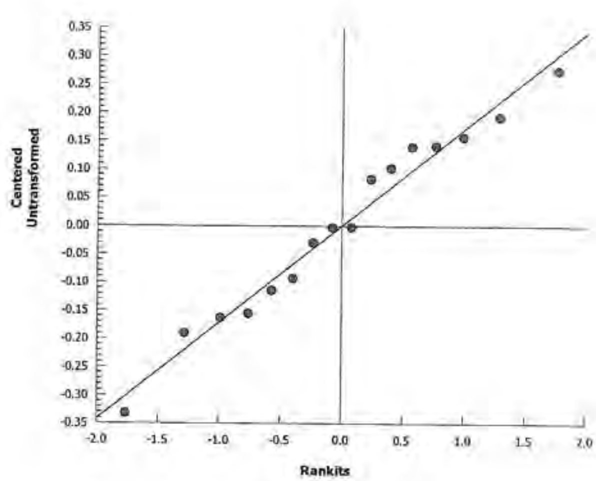
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 8 | 1.802 | 1.681 | 1.923 | 1.786 | 1.612 | 1.994 | 0.05107 | 8.02% | 0.00% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.676 | 1.305 | 1.911 | 0.069 | 11.92% | 9.16% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 1.772 | 1.612 | 1.8 | 1.647 | 1.941 | 1.709 | 1.943 | 1.994 |
| 50419 | | 1.474 | 1.634 | 1.793 | 1.911 | 1.305 | 1.719 | 1.522 | 1.738 |

**Graphics**



## CETIS Test Data Worksheet

Report Date: 08 Sep-17 14:34 (p 1 of 3)
Test Code/ID: 13-8139-4602/80703 (C)

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Start Date:** | 01 Aug-17 19:30 | **Species:** | Chironomus dilutus | **Sample Code:** | 50431 |
| **End Date:** | 11 Aug-17 16:45 | **Protocol:** | EPA/600/R-99/064 (2000) | **Sample Source:** | PEPCO Benning Rd-Waterside Inve |
| **Sample Date:** | 12 Jun-17 12:00 | **Material:** | Reference sediment | **Sample Station:** | SEDBACK1700N |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | 1 | 98 | 10 | 8 | 2277.76 | 2268.9 | 5 | | | |
| 50431 | 2 | 28 | 10 | 9 | 2312.07 | 2302.4 | 6 | | | |
| 50431 | 3 | 101 | 10 | 10 | 2391.41 | 2378.81 | 7 | | | |
| 50431 | 4 | 62 | 10 | 9 | 2276.07 | 2261.25 | 9 | | | |
| 50431 | 5 | 99 | 10 | 9 | 2281.55 | 2266.02 | 8 | | | |
| 50431 | 6 | 17 | 10 | 9 | 2210.04 | 2196.37 | 8 | | | |
| 50431 | 7 | 24 | 10 | 10 | 2391.89 | 2372.46 | 10 | | | |
| 50431 | 8 | 68 | 10 | 8 | 2189.89 | 2179.92 | 5 | | | |
| 50415 | 1 | 51 | 10 | 9 | 2299.25 | 2286.92 | 7 | | | |
| 50415 | 2 | 15 | 10 | 9 | 2339.95 | 2325.75 | 8 | | | |
| 50415 | 3 | 82 | 10 | 10 | 2295.3 | 2284.82 | 6 | | | |
| 50415 | 4 | 80 | 10 | 8 | 2405.82 | 2393.04 | 7 | | | |
| 50415 | 5 | 63 | 10 | 7 | 2498.95 | 2488.51 | 5 | | | |
| 50415 | 6 | 110 | 10 | 10 | 2278.14 | 2268.15 | 6 | | | |
| 50415 | 7 | 20 | 10 | 10 | 2397.55 | 2387.89 | 7 | | | |
| 50415 | 8 | 112 | 10 | 10 | 2444.03 | 2430.72 | 8 | | | |
| 50416 | 1 | 66 | 10 | 8 | 2462.55 | 2449.1 | 7 | | | |
| 50416 | 2 | 54 | 10 | 10 | 2324.27 | 2307.53 | 10 | | | |
| 50416 | 3 | 124 | 10 | 9 | 2399.91 | 2384.98 | 9 | | | |
| 50416 | 4 | 33 | 10 | 9 | 2398.18 | 2384.28 | 9 | | | |
| 50416 | 5 | 47 | 10 | 8 | 2231.44 | 2220.49 | 7 | | | |
| 50416 | 6 | 113 | 10 | 9 | 2437.69 | 2425.83 | 7 | | | |
| 50416 | 7 | 14 | 10 | 7 | 2322.69 | 2309.34 | 7 | | | |
| 50416 | 8 | 118 | 10 | 8 | 2316.59 | 2305.31 | 6 | | | |
| 50417 | 1 | 74 | 10 | 8 | 2178.96 | 2166.89 | 8 | | | |
| 50417 | 2 | 27 | 10 | 9 | 2164.7 | 2152.7 | 8 | | | |
| 50417 | 3 | 125 | 10 | 9 | 2115.26 | 2106.43 | 7 | | | |
| 50417 | 4 | 89 | 10 | 8 | 2199.69 | 2189.42 | 6 | | | |
| 50417 | 5 | 50 | 10 | 10 | 2266.87 | 2253.57 | 10 | | | |
| 50417 | 6 | 106 | 10 | 10 | 2153.9 | 2143.5 | 9 | | | |
| 50417 | 7 | 102 | 10 | 9 | 2047.12 | 2034.85 | 9 | | | |
| 50417 | 8 | 6 | 10 | 8 | 2179.02 | 2168.94 | 7 | | | |
| 50418 | 1 | 53 | 10 | 8 | 2172.05 | 2160.19 | 6 | | | |
| 50418 | 2 | 46 | 10 | 8 | 2198.71 | 2185.35 | 7 | | | |
| 50418 | 3 | 43 | 10 | 9 | 2078.14 | 2061.64 | 9 | | | |
| 50418 | 4 | 85 | 10 | 9 | 2208 | 2197.59 | 6 | | | |
| 50418 | 5 | 61 | 10 | 9 | 2128.59 | 2115.46 | 8 | | | |
| 50418 | 6 | 111 | 10 | 10 | 2211.14 | 2197.63 | 8 | | | |
| 50418 | 7 | 126 | 10 | 9 | 2226.28 | 2208.7 | 9 | | | |
| 50418 | 8 | 25 | 10 | 8 | 2232.01 | 2221.08 | 5 | | | |
| 50419 | 1 | 87 | 10 | 10 | 2137.6 | 2122.86 | 10 | | | |
| 50419 | 2 | 59 | 10 | 10 | 2075.08 | 2058.74 | 10 | | | |
| 50419 | 3 | 71 | 10 | 9 | 2203.29 | 2187.15 | 9 | | | |
| 50419 | 4 | 12 | 10 | 8 | 2156.5 | 2143.12 | 7 | | | |
| 50419 | 5 | 97 | 10 | 10 | 2220.4 | 2207.35 | 10 | | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 18 | 10 | 9 | 2207.66 | 2193.91 | 8 | | | |
| 50419 | 7 | 45 | 10 | 10 | 2197.41 | 2185.23 | 8 | | | |
| 50419 | 8 | 36 | 10 | 8 | 2235.22 | 2224.79 | 6 | | | |
| 50420 | 1 | 58 | 10 | 10 | 2198.79 | 2180.89 | 10 | | | |
| 50420 | 2 | 52 | 10 | 8 | 2222.76 | 2211.32 | 6 | | | |
| 50420 | 3 | 34 | 10 | 9 | 2180.75 | 2167.6 | 7 | | | |
| 50420 | 4 | 103 | 10 | 7 | 2474.78 | 2459.82 | 6 | | | |
| 50420 | 5 | 122 | 10 | 10 | 2157.79 | 2146.15 | 7 | | | |
| 50420 | 6 | 83 | 10 | 10 | 2124.4 | 2111.22 | 8 | | | |
| 50420 | 7 | 115 | 10 | 8 | 2127.79 | 2114.35 | 7 | | | |
| 50420 | 8 | 117 | 10 | 10 | 2134.34 | 2117.45 | 9 | | | |
| 50421 | 1 | 107 | 10 | 10 | 2039.98 | 2024.45 | 8 | | | |
| 50421 | 2 | 95 | 10 | 10 | 2243.29 | 2228.16 | 9 | | | |
| 50421 | 3 | 29 | 10 | 8 | 2191.22 | 2178.52 | 7 | | | |
| 50421 | 4 | 105 | 10 | 10 | 2128.78 | 2114.79 | 8 | | | |
| 50421 | 5 | 7 | 10 | 9 | 2140.17 | 2128.31 | 7 | | | |
| 50421 | 6 | 56 | 10 | 10 | 2120.11 | 2103.95 | 9 | | | |
| 50421 | 7 | 42 | 10 | 10 | 2199.8 | 2185.26 | 8 | | | |
| 50421 | 8 | 100 | 10 | 8 | 2219.81 | 2205.45 | 8 | | | |
| 50422 | 1 | 116 | 10 | 10 | 2161.55 | 2145.53 | 9 | | | |
| 50422 | 2 | 31 | 10 | 8 | 2297.93 | 2285.49 | 7 | | | |
| 50422 | 3 | 88 | 10 | 8 | 2083.43 | 2069.21 | 7 | | | |
| 50422 | 4 | 9 | 10 | 10 | 2035.97 | 2024.78 | 7 | | | |
| 50422 | 5 | 57 | 10 | 9 | 2208.11 | 2196.89 | 6 | | | |
| 50422 | 6 | 92 | 10 | 10 | 2214.72 | 2200.73 | 7 | | | |
| 50422 | 7 | 2 | 10 | 10 | 2162.86 | 2149.53 | 8 | | | |
| 50422 | 8 | 32 | 10 | 9 | 2321.46 | 2309.51 | 6 | | | |
| 50423 | 1 | 5 | 10 | 7 | 2544.52 | 2535.91 | 4 | | | |
| 50423 | 2 | 72 | 10 | 7 | 2219.01 | 2205.81 | 6 | | | |
| 50423 | 3 | 86 | 10 | 9 | 2204.08 | 2190.81 | 8 | | | |
| 50423 | 4 | 4 | 10 | 9 | 2259.73 | 2246.28 | 9 | | | |
| 50423 | 5 | 73 | 10 | 10 | 2066.62 | 2050.05 | 10 | | | |
| 50423 | 6 | 128 | 10 | 9 | 2143.49 | 2125.5 | 9 | | | |
| 50423 | 7 | 60 | 10 | 10 | 2207.57 | 2195.3 | 7 | | | |
| 50423 | 8 | 26 | 10 | 9 | 2129.45 | 2121.78 | 3 | | | |
| 50424 | 1 | 114 | 10 | 9 | 2190.71 | 2178.87 | 7 | | | |
| 50424 | 2 | 84 | 10 | 8 | 2174.42 | 2161.76 | 7 | | | |
| 50424 | 3 | 91 | 10 | 10 | 2108.99 | 2096.47 | 9 | | | |
| 50424 | 4 | 94 | 10 | 9 | 2449.83 | 2438.53 | 7 | | | |
| 50424 | 5 | 70 | 10 | 7 | 2267.91 | 2258.05 | 5 | | | |
| 50424 | 6 | 1 | 10 | 9 | 2081.98 | 2071.02 | 6 | | | |
| 50424 | 7 | 44 | 10 | 8 | 2261.58 | 2248.59 | 7 | | | |
| 50424 | 8 | 41 | 10 | 10 | 2228.99 | 2212.83 | 10 | | | |
| 50425 | 1 | 90 | 10 | 9 | 2119.13 | 2106.53 | 7 | | | |
| 50425 | 2 | 78 | 10 | 10 | 2240.25 | 2227.55 | 7 | | | |
| 50425 | 3 | 23 | 10 | 9 | 2214.27 | 2202.56 | 7 | | | |
| 50425 | 4 | 37 | 10 | 8 | 2139.09 | 2126.93 | 6 | | | |
| 50425 | 5 | 127 | 10 | 9 | 2309.43 | 2295.66 | 8 | | | |
| 50425 | 6 | 69 | 10 | 9 | 2227.23 | 2215.05 | 7 | | | |
| 50425 | 7 | 16 | 10 | 7 | 2164.29 | 2159.13 | 2 | | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 119 | 10 | 10 | 2163.2 | 2149.99 | 8 | | | |
| 50426 | 1 | 67 | 10 | 9 | 2226.31 | 2213.52 | 8 | | | |
| 50426 | 2 | 121 | 10 | 7 | 2354.81 | 2340.68 | 7 | | | |
| 50426 | 3 | 30 | 10 | 9 | 2231.22 | 2218.04 | 8 | | | |
| 50426 | 4 | 55 | 10 | 8 | 2444.87 | 2433.46 | 6 | | | |
| 50426 | 5 | 109 | 10 | 7 | 2390.31 | 2379.17 | 5 | | | |
| 50426 | 6 | 11 | 10 | 7 | 2362.15 | 2350.34 | 6 | | | |
| 50426 | 7 | 22 | 10 | 10 | 2343.96 | 2331.77 | 9 | | | |
| 50426 | 8 | 48 | 10 | 9 | 2407.34 | 2396.27 | 7 | | | |
| 50427 | 1 | 49 | 10 | 8 | 2476.02 | 2467.02 | 4 | | | |
| 50427 | 2 | 96 | 10 | 6 | 2366.13 | 2356.99 | 4 | | | |
| 50427 | 3 | 76 | 10 | 8 | 2428.5 | 2413.79 | 7 | | | |
| 50427 | 4 | 77 | 10 | 9 | 2373.14 | 2360.36 | 6 | | | |
| 50427 | 5 | 65 | 10 | 10 | 2343.17 | 2325.07 | 10 | | | |
| 50427 | 6 | 104 | 10 | 10 | 2273.99 | 2261.18 | 8 | | | |
| 50427 | 7 | 108 | 10 | 7 | 2364.6 | 2355.23 | 5 | | | |
| 50427 | 8 | 3 | 10 | 10 | 2223.49 | 2210.73 | 8 | | | |
| 50428 | 1 | 81 | 10 | 10 | 2391.69 | 2377.49 | 8 | | | |
| 50428 | 2 | 64 | 10 | 8 | 2155.16 | 2142.61 | 6 | | | |
| 50428 | 3 | 35 | 10 | 10 | 2183.72 | 2168.43 | 9 | | | |
| 50428 | 4 | 21 | 10 | 8 | 2274.73 | 2264.08 | 6 | | | |
| 50428 | 5 | 39 | 10 | 8 | 2493.86 | 2484.17 | 5 | | | |
| 50428 | 6 | 123 | 10 | 8 | 2350.13 | 2334.55 | 8 | | | |
| 50428 | 7 | 120 | 10 | 8 | 2337.99 | 2323.78 | 7 | | | |
| 50428 | 8 | 13 | 10 | 10 | 2189.29 | 2171.95 | 10 | | | |
| 50429 | 1 | 93 | 10 | 9 | 2281.62 | 2266.05 | 8 | | | |
| 50429 | 2 | 40 | 10 | 9 | 2443.35 | 2429.48 | 7 | | | |
| 50429 | 3 | 38 | 10 | 8 | 2242.71 | 2230.96 | 6 | | | |
| 50429 | 4 | 8 | 10 | 10 | 2247.5 | 2229.58 | 10 | | | |
| 50429 | 5 | 10 | 10 | 10 | 2390.01 | 2374.08 | 9 | | | |
| 50429 | 6 | 79 | 10 | 7 | 2362.13 | 2353.08 | 5 | | | |
| 50429 | 7 | 75 | 10 | 8 | 2413.47 | 2404.32 | 5 | | | |
| 50429 | 8 | 19 | 10 | 10 | 2306.54 | 2290.94 | 8 | | | |

*Chironomus dilutus*

10-day survival and

growth test (ash-free dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1800N

(Aquatec Sample # 50432)

STATISTICAL COMPARISONS TO 50432
(SEDBACK1800N)



**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 11-1986-8050 | **Test Type:** | Survival-AF Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 01 Aug-17 19:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 11 Aug-17 16:45 | **Species:** | Chironomus dilutus | **Brine:** | |
| **Duration:** | 9d 21h | **Source:** | Aquatic Biosystems, CO | **Age:** | |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 09-8125-9978 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0142 | 50415 failed mean af weight-mg |
| 03-9654-5929 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0092 | 50416 failed mean af weight-mg |
| 06-0952-0596 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 6.6E-05 | 50417 failed mean af weight-mg |
| 19-4841-1776 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0797 | 50418 passed mean af weight-mg |
| 15-5706-4237 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0030 | 50419 failed mean af weight-mg |
| 04-4098-7812 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1491 | 50420 passed mean af weight-mg |
| 14-8700-5071 | Mean AF Weight-mg | Unequal Variance t Two-Sample Test | 0.0222 | 50421 failed mean af weight-mg |
| 04-1180-1940 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0519 | 50422 passed mean af weight-mg |
| 20-1659-0243 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.2465 | 50423 passed mean af weight-mg |
| 13-9739-4551 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0100 | 50424 failed mean af weight-mg |
| 00-3589-5362 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1361 | 50425 passed mean af weight-mg |
| 13-2834-6474 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0483 | 50426 failed mean af weight-mg |
| 07-0396-9385 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.2622 | 50427 passed mean af weight-mg |
| 13-7236-8590 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0801 | 50428 passed mean af weight-mg |
| 06-9433-8111 | Mean AF Weight-mg | Unequal Variance t Two-Sample Test | 0.0823 | 50429 passed mean af weight-mg |
| 03-4196-3849 | Survival Rate | Equal Variance t Two-Sample Test | 0.8247 | 50415 passed survival rate |
| 08-2776-8481 | Survival Rate | Equal Variance t Two-Sample Test | 0.3894 | 50416 passed survival rate |
| 14-2790-8776 | Survival Rate | Equal Variance t Two-Sample Test | 0.6733 | 50417 passed survival rate |
| 20-8142-8780 | Survival Rate | Equal Variance t Two-Sample Test | 0.5703 | 50418 passed survival rate |
| 15-3688-3281 | Survival Rate | Equal Variance t Two-Sample Test | 0.8846 | 50419 passed survival rate |
| 16-6013-5544 | Survival Rate | Equal Variance t Two-Sample Test | 0.7566 | 50420 passed survival rate |
| 08-4367-4566 | Survival Rate | Equal Variance t Two-Sample Test | 0.9237 | 50421 passed survival rate |
| 03-8579-5956 | Survival Rate | Equal Variance t Two-Sample Test | 0.8846 | 50422 passed survival rate |
| 15-9965-9353 | Survival Rate | Equal Variance t Two-Sample Test | 0.6033 | 50423 passed survival rate |
| 20-6076-6952 | Survival Rate | Equal Variance t Two-Sample Test | 0.5913 | 50424 passed survival rate |
| 10-9107-1035 | Survival Rate | Equal Variance t Two-Sample Test | 0.6814 | 50425 passed survival rate |
| 01-8188-0868 | Survival Rate | Equal Variance t Two-Sample Test | 0.2681 | 50426 passed survival rate |
| 02-1889-7356 | Survival Rate | Equal Variance t Two-Sample Test | 0.4687 | 50427 passed survival rate |
| 14-0752-5618 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5435 | 50428 passed survival rate |
| 13-4451-9022 | Survival Rate | Equal Variance t Two-Sample Test | 0.6814 | 50429 passed survival rate |

Chironomus 10-d Survival and Growth Sediment Test — Aquatec Environmental, Inc.

### Mean AF Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 1.519 | 2.435 | 0.1072 | 0.3032 | 14.79% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.38 | 2.088 | 0.06959 | 0.1968 | 11.32% | 15.22% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.544 | 1.921 | 0.05377 | 0.1521 | 8.79% | 15.60% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.156 | 1.712 | 0.06052 | 0.1712 | 12.15% | 31.29% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.641 | 2.186 | 0.06328 | 0.179 | 9.59% | 9.02% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.305 | 1.911 | 0.069 | 0.1952 | 11.92% | 20.15% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.647 | 2.493 | 0.09311 | 0.2634 | 13.88% | 7.48% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.681 | 1.941 | 0.02893 | 0.08183 | 4.58% | 12.89% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.599 | 2.031 | 0.05696 | 0.1611 | 8.76% | 10.30% |
| 50423 | | 8 | 1.934 | 1.636 | 2.232 | 1.494 | 2.557 | 0.126 | 0.3564 | 18.43% | 5.68% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.391 | 1.972 | 0.06438 | 0.1821 | 10.57% | 16.02% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.651 | 2.58 | 0.1087 | 0.3076 | 16.40% | 8.51% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.354 | 2.228 | 0.1016 | 0.2875 | 16.08% | 12.83% |
| 50427 | | 8 | 1.956 | 1.726 | 2.186 | 1.595 | 2.285 | 0.09731 | 0.2752 | 14.07% | 4.61% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.699 | 2.092 | 0.05194 | 0.1469 | 7.84% | 8.61% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.77 | 1.981 | 0.03076 | 0.08699 | 4.63% | 8.32% |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 0.8625 | 0.7738 | 0.9512 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 12.30% | 0.00% |
| 50415 | | 8 | 0.9125 | 0.8184 | 1.0000 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.34% | -5.80% |
| 50416 | | 8 | 0.8500 | 0.7726 | 0.9274 | 0.7000 | 1.0000 | 0.0327 | 0.0926 | 10.89% | 1.45% |
| 50417 | | 8 | 0.8875 | 0.8177 | 0.9573 | 0.8000 | 1.0000 | 0.0295 | 0.0835 | 9.40% | -2.90% |
| 50418 | | 8 | 0.8750 | 0.8159 | 0.9341 | 0.8000 | 1.0000 | 0.0250 | 0.0707 | 8.08% | -1.45% |
| 50419 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -7.25% |
| 50420 | | 8 | 0.9000 | 0.8001 | 0.9999 | 0.7000 | 1.0000 | 0.0423 | 0.1195 | 13.28% | -4.35% |
| 50421 | | 8 | 0.9375 | 0.8609 | 1.0000 | 0.8000 | 1.0000 | 0.0324 | 0.0916 | 9.77% | -8.70% |
| 50422 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -7.25% |
| 50423 | | 8 | 0.8750 | 0.7776 | 0.9724 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 13.31% | -1.45% |
| 50424 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.7000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | -1.45% |
| 50425 | | 8 | 0.8875 | 0.8046 | 0.9704 | 0.7000 | 1.0000 | 0.0350 | 0.0991 | 11.17% | -2.90% |
| 50426 | | 8 | 0.8250 | 0.7276 | 0.9224 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 14.12% | 4.35% |
| 50427 | | 8 | 0.8500 | 0.7236 | 0.9764 | 0.6000 | 1.0000 | 0.0535 | 0.1512 | 17.79% | 1.45% |
| 50428 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.8000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | -1.45% |
| 50429 | | 8 | 0.8875 | 0.7934 | 0.9816 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.69% | -2.90% |

## CETIS Analytical Report

Report Date: 08 Sep-17 15:23 (p 1 of 1)
Test Code: 80704 (D) | 12-9251-9486

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 09-8125-9978 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:17 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | Sediment Testing |
| 50415 | 05-7381-9684 | 07 Jun-17 10:00 | 15 Jun-17 16:35 | 55d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50415 | Sediment | PEPCO Benning Rd-Waterside In | SED6C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50415 failed mean af weight-mg | 10.98% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50415* | 2.443 | 1.761 | 0.225 | 14 | CDF | 0.0142 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.389772 | 0.389772 | 1 | 5.967 | 0.0284 | Significant Effect |
| Error | 0.914492 | 0.0653209 | 14 | | | |
| Total | 1.30426 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.372 | 8.885 | 0.2770 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9439 | 0.8408 | 0.4001 | Normal Distribution |

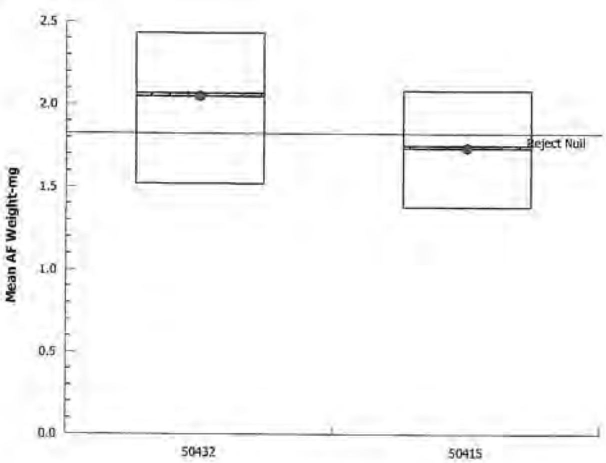
### Mean AF Weight-mg Summary

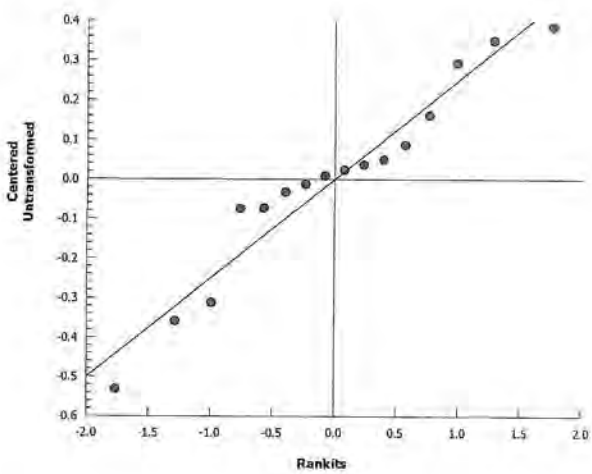
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 2.069 | 1.519 | 2.435 | 0.1072 | 14.79% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.754 | 1.38 | 2.088 | 0.06959 | 11.32% | 15.22% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 2.017 | 2.038 | 1.519 | 2.1 | 2.343 | 1.739 | 2.435 | 2.212 |
| 50415 | | 1.761 | 1.775 | 1.747 | 1.826 | 2.088 | 1.665 | 1.38 | 1.664 |

### Graphics



## CETIS Analytical Report

Report Date: 08 Sep-17 15:23 (p 1 of 1)
Test Code: 80704 (D) | 12-9251-9486

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 03-9654-5929 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:18 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | Sediment Testing |
| 50416 | 17-8931-1896 | 07 Jun-17 11:30 | 15 Jun-17 16:35 | 55d 8h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50416 | Sediment | PEPCO Benning Rd-Waterside In | SED8C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50416 failed mean af weight-mg | 10.30% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50416* | 2.667 | 1.761 | 0.211 | 14 | CDF | 0.0092 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.409103 | 0.409103 | 1 | 7.113 | 0.0184 | Significant Effect |
| Error | 0.805207 | 0.0575148 | 14 | | | |
| Total | 1.21431 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.974 | 8.885 | 0.0890 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9699 | 0.8408 | 0.8367 | Normal Distribution |

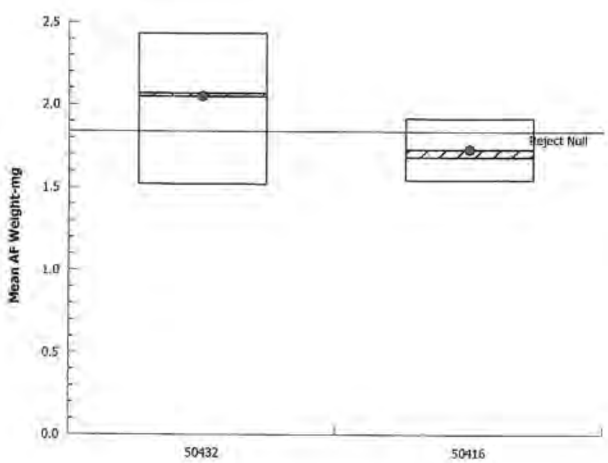
### Mean AF Weight-mg Summary

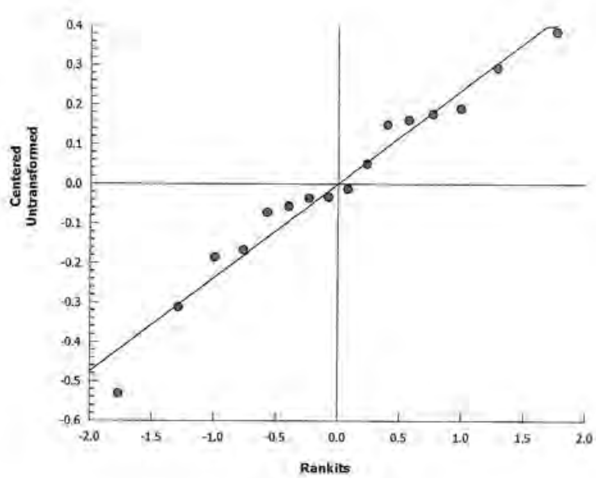
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 2.069 | 1.519 | 2.435 | 0.1072 | 14.79% | 0.00% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.684 | 1.544 | 1.921 | 0.05377 | 8.79% | 15.60% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 2.017 | 2.038 | 1.519 | 2.1 | 2.343 | 1.739 | 2.435 | 2.212 |
| 50416 | | 1.921 | 1.674 | 1.659 | 1.544 | 1.564 | 1.694 | 1.907 | 1.88 |

### Graphics



# CETIS Analytical Report

Report Date: 08 Sep-17 15:23 (p 1 of 1)
Test Code: 80704 (D) | 12-9251-9486

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 06-0952-0596 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:18 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 55d 7h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean af weight-mg | 10.57% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 5.212 | 1.761 | 0.217 | 14 | CDF | 6.6E-05 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.64615 | 1.64615 | 1 | 27.16 | 1.3E-04 | Significant Effect |
| Error | 0.848466 | 0.0606047 | 14 | | | |
| Total | 2.49461 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.136 | 8.885 | 0.1546 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9725 | 0.8408 | 0.8771 | Normal Distribution |

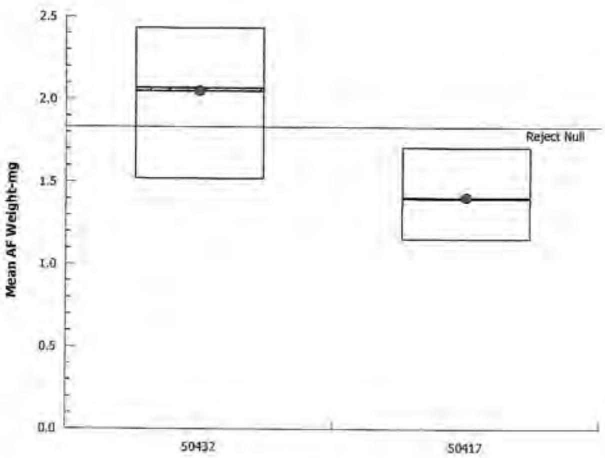
### Mean AF Weight-mg Summary

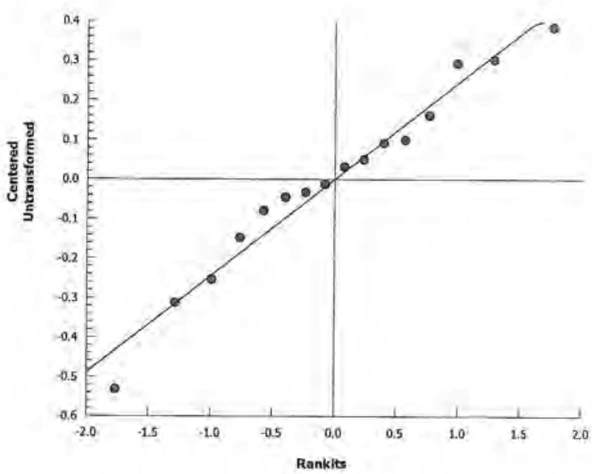
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 2.069 | 1.519 | 2.435 | 0.1072 | 14.79% | 0.00% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.402 | 1.156 | 1.712 | 0.06052 | 12.15% | 31.29% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 2.017 | 2.038 | 1.519 | 2.1 | 2.343 | 1.739 | 2.435 | 2.212 |
| 50417 | | 1.509 | 1.5 | 1.261 | 1.712 | 1.33 | 1.156 | 1.363 | 1.44 |

### Graphics



# CETIS Analytical Report

| | |
|---|---|
| Report Date: | 08 Sep-17 15:23 (p 1 of 1) |
| Test Code: | 80704 (D) \| 12-9251-9486 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 15-5706-4237 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:18 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 54d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean af weight-mg | 10.95% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50419* | 3.241 | 1.761 | 0.225 | 14 | CDF | 0.0030 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.682912 | 0.682912 | 1 | 10.51 | 0.0059 | Significant Effect |
| Error | 0.909947 | 0.0649962 | 14 | | | |
| Total | 1.59286 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.413 | 8.885 | 0.2680 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9687 | 0.8408 | 0.8169 | Normal Distribution |

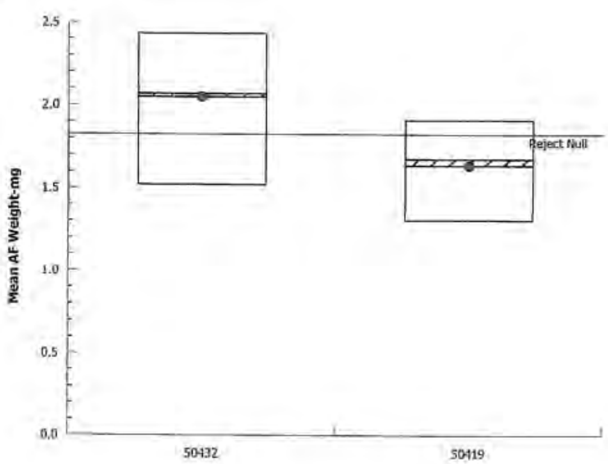
### Mean AF Weight-mg Summary

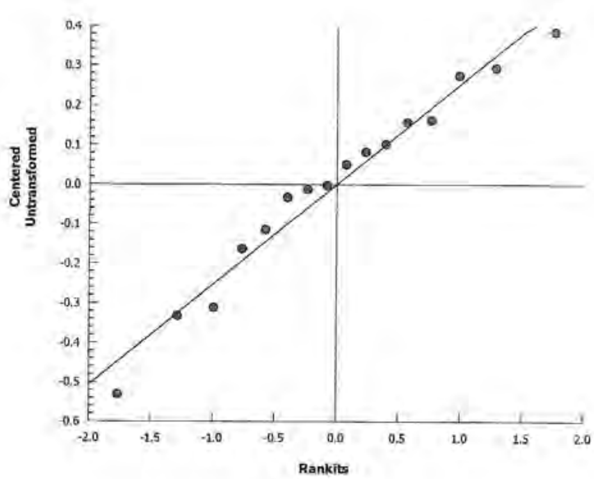
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 2.069 | 1.519 | 2.435 | 0.1072 | 14.79% | 0.00% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.676 | 1.305 | 1.911 | 0.069 | 11.92% | 20.15% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 2.017 | 2.038 | 1.519 | 2.1 | 2.343 | 1.739 | 2.435 | 2.212 |
| 50419 | | 1.474 | 1.634 | 1.793 | 1.911 | 1.305 | 1.719 | 1.522 | 1.738 |

### Graphics



# CETIS Analytical Report

| | | | |
|---|---|---|---|
| Report Date: | 08 Sep-17 15:22 (p 1 of 1) | | |
| Test Code: | 80704 (D) \| 12-9251-9486 | | |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 14-8700-5071 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:18 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | Sediment Testing |
| 50421 | 10-8432-1021 | 08 Jun-17 10:30 | 15 Jun-17 16:35 | 54d 9h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50421 | Sediment | PEPCO Benning Rd-Waterside In | SED7E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50421 failed mean af weight-mg | 10.07% |

### Unequal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50421* | 2.381 | 1.86 | 0.206 | 8 | CDF | 0.0222 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.2796 | 0.2796 | 1 | 5.671 | 0.0320 | Significant Effect |
| Error | 0.690194 | 0.0492996 | 14 | | | |
| Total | 0.969794 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 13.73 | 8.885 | 0.0027 | Unequal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9246 | 0.8408 | 0.1998 | Normal Distribution |

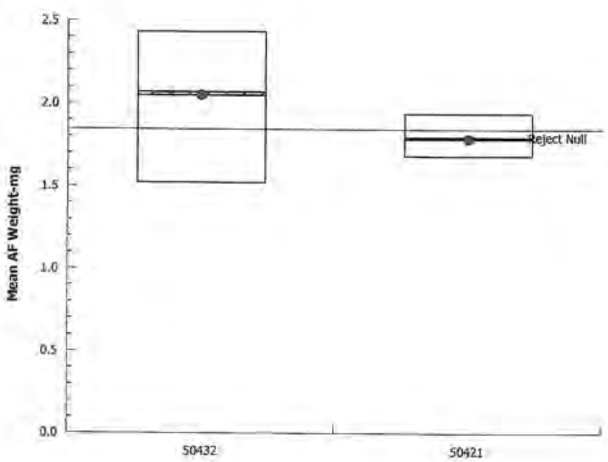
### Mean AF Weight-mg Summary

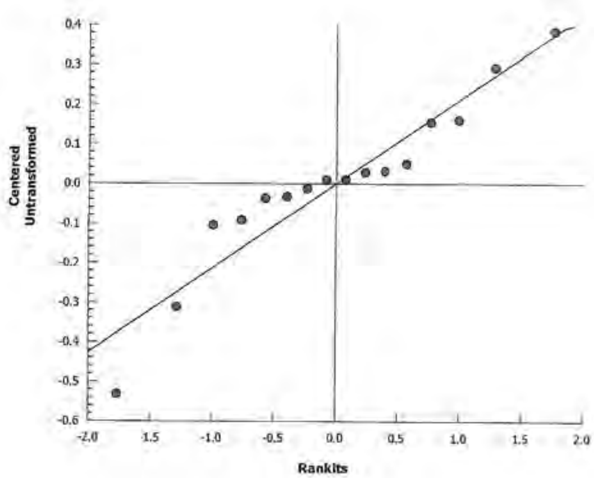
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 2.069 | 1.519 | 2.435 | 0.1072 | 14.79% | 0.00% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.795 | 1.681 | 1.941 | 0.02893 | 4.58% | 12.89% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 2.017 | 2.038 | 1.519 | 2.1 | 2.343 | 1.739 | 2.435 | 2.212 |
| 50421 | | 1.941 | 1.681 | 1.814 | 1.749 | 1.694 | 1.796 | 1.818 | 1.795 |

### Graphics



## CETIS Analytical Report

Report Date: 08 Sep-17 15:22 (p 1 of 1)
Test Code: 80704 (D) | 12-9251-9486

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 13-9739-4551 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:18 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | Sediment Testing |
| 50424 | 00-7068-4401 | 09 Jun-17 08:15 | 15 Jun-17 16:35 | 53d 11h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50424 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50424 failed mean af weight-mg | 10.74% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50424* | 2.627 | 1.761 | 0.220 | 14 | CDF | 0.0100 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.431368 | 0.431368 | 1 | 6.899 | 0.0199 | Significant Effect |
| Error | 0.875396 | 0.0625283 | 14 | | | |
| Total | 1.30676 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.772 | 8.885 | 0.2020 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9647 | 0.8408 | 0.7467 | Normal Distribution |

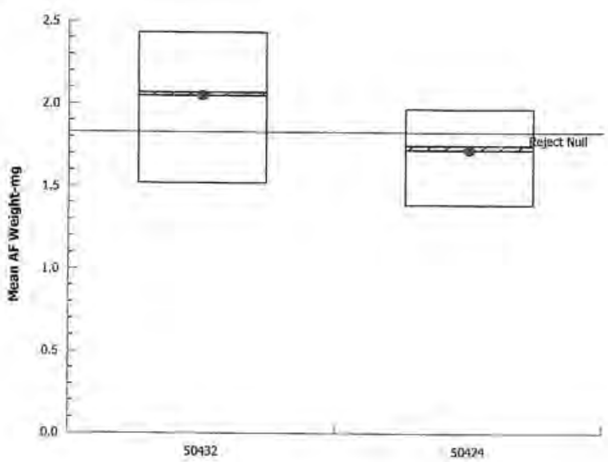
### Mean AF Weight-mg Summary

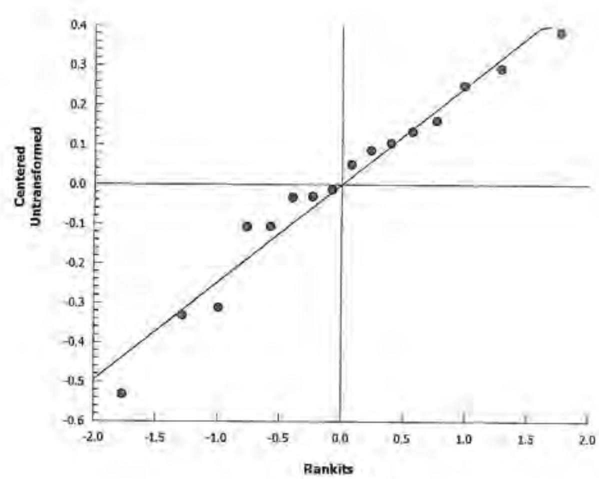
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 2.069 | 1.519 | 2.435 | 0.1072 | 14.79% | 0.00% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.75 | 1.391 | 1.972 | 0.06438 | 10.57% | 16.02% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 2.017 | 2.038 | 1.519 | 2.1 | 2.343 | 1.739 | 2.435 | 2.212 |
| 50424 | | 1.691 | 1.809 | 1.391 | 1.614 | 1.972 | 1.827 | 1.856 | 1.616 |

### Graphics



## CETIS Analytical Report

| | |
|---|---|
| Report Date: | 08 Sep-17 15:22 (p 1 of 1) |
| Test Code: | 80704 (D) \| 12-9251-9486 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 13-2834-6474 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:18 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | Sediment Testing |
| 50426 | 17-5556-0091 | 09 Jun-17 09:45 | 15 Jun-17 16:35 | 53d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50426 | Sediment | PEPCO Benning Rd-Waterside In | SED6.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50426 failed mean af weight-mg | 12.69% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50426* | 1.781 | 1.761 | 0.260 | 14 | CDF | 0.0483 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.276707 | 0.276707 | 1 | 3.171 | 0.0967 | Non-Significant Effect |
| Error | 1.22175 | 0.0872679 | 14 | | | |
| Total | 1.49846 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.112 | 8.885 | 0.8920 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9752 | 0.8408 | 0.9144 | Normal Distribution |

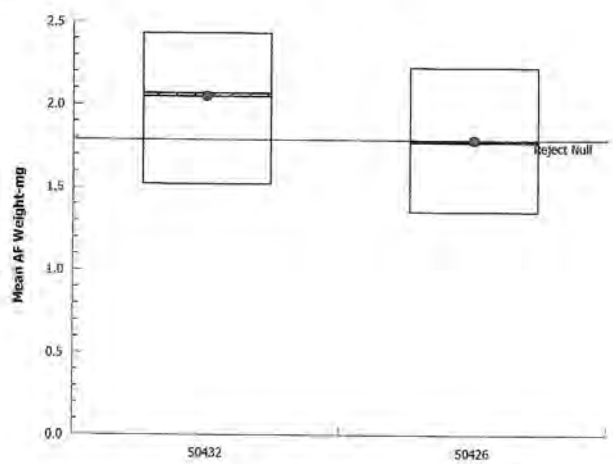
**Mean AF Weight-mg Summary**

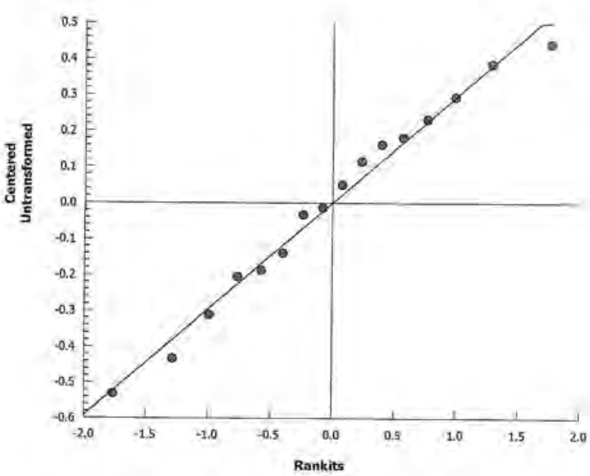
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 2.05 | 1.797 | 2.304 | 2.069 | 1.519 | 2.435 | 0.1072 | 14.79% | 0.00% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.775 | 1.354 | 2.228 | 0.1016 | 16.08% | 12.83% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 2.017 | 2.038 | 1.519 | 2.1 | 2.343 | 1.739 | 2.435 | 2.212 |
| 50426 | | 1.599 | 2.019 | 1.647 | 1.902 | 2.228 | 1.968 | 1.354 | 1.581 |

**Graphics**



## CETIS Test Data Worksheet

| | |
|---|---|
| Report Date: | 08 Sep-17 14:42 (p 1 of 3) |
| Test Code/ID: | 12-9251-9486/80704 (D) |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Start Date:** | 01 Aug-17 19:30 | **Species:** | Chironomus dilutus | **Sample Code:** | 50432 |
| **End Date:** | 11 Aug-17 16:45 | **Protocol:** | EPA/600/R-99/064 (2000) | **Sample Source:** | PEPCO Benning Rd-Waterside Inve |
| **Sample Date:** | 12 Jun-17 13:15 | **Material:** | Reference sediment | **Sample Station:** | SEDBACK1800N |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | 1 | 97 | 10 | 9 | 2245.18 | 2229.04 | 8 | | | |
| 50432 | 2 | 13 | 10 | 9 | 2439.27 | 2422.97 | 8 | | | |
| 50432 | 3 | 117 | 10 | 10 | 2293.81 | 2281.66 | 8 | | | |
| 50432 | 4 | 7 | 10 | 8 | 2418.58 | 2408.08 | 5 | | | |
| 50432 | 5 | 18 | 10 | 8 | 2292.05 | 2277.99 | 6 | | | |
| 50432 | 6 | 120 | 10 | 10 | 2370.38 | 2356.47 | 8 | | | |
| 50432 | 7 | 26 | 10 | 7 | 2357.78 | 2348.04 | 4 | | | |
| 50432 | 8 | 73 | 10 | 8 | 2446.1 | 2435.04 | 5 | | | |
| 50415 | 1 | 57 | 10 | 9 | 2299.25 | 2286.92 | 7 | | | |
| 50415 | 2 | 83 | 10 | 9 | 2339.95 | 2325.75 | 8 | | | |
| 50415 | 3 | 16 | 10 | 10 | 2295.3 | 2284.82 | 6 | | | |
| 50415 | 4 | 114 | 10 | 8 | 2405.82 | 2393.04 | 7 | | | |
| 50415 | 5 | 91 | 10 | 7 | 2498.95 | 2488.51 | 5 | | | |
| 50415 | 6 | 15 | 10 | 10 | 2278.14 | 2268.15 | 6 | | | |
| 50415 | 7 | 19 | 10 | 10 | 2397.55 | 2387.89 | 7 | | | |
| 50415 | 8 | 67 | 10 | 10 | 2444.03 | 2430.72 | 8 | | | |
| 50416 | 1 | 11 | 10 | 8 | 2462.55 | 2449.1 | 7 | | | |
| 50416 | 2 | 56 | 10 | 10 | 2324.27 | 2307.53 | 10 | | | |
| 50416 | 3 | 42 | 10 | 9 | 2399.91 | 2384.98 | 9 | | | |
| 50416 | 4 | 126 | 10 | 9 | 2398.18 | 2384.28 | 9 | | | |
| 50416 | 5 | 1 | 10 | 8 | 2231.44 | 2220.49 | 7 | | | |
| 50416 | 6 | 62 | 10 | 9 | 2437.69 | 2425.83 | 7 | | | |
| 50416 | 7 | 9 | 10 | 7 | 2322.69 | 2309.34 | 7 | | | |
| 50416 | 8 | 84 | 10 | 8 | 2316.59 | 2305.31 | 6 | | | |
| 50417 | 1 | 104 | 10 | 8 | 2178.96 | 2166.89 | 8 | | | |
| 50417 | 2 | 25 | 10 | 9 | 2164.7 | 2152.7 | 8 | | | |
| 50417 | 3 | 49 | 10 | 9 | 2115.26 | 2106.43 | 7 | | | |
| 50417 | 4 | 61 | 10 | 8 | 2199.69 | 2189.42 | 6 | | | |
| 50417 | 5 | 27 | 10 | 10 | 2266.87 | 2253.57 | 10 | | | |
| 50417 | 6 | 3 | 10 | 10 | 2153.9 | 2143.5 | 9 | | | |
| 50417 | 7 | 35 | 10 | 9 | 2047.12 | 2034.85 | 9 | | | |
| 50417 | 8 | 4 | 10 | 8 | 2179.02 | 2168.94 | 7 | | | |
| 50418 | 1 | 112 | 10 | 8 | 2172.05 | 2160.19 | 6 | | | |
| 50418 | 2 | 64 | 10 | 8 | 2198.71 | 2185.35 | 7 | | | |
| 50418 | 3 | 98 | 10 | 9 | 2078.14 | 2061.64 | 9 | | | |
| 50418 | 4 | 40 | 10 | 9 | 2208 | 2197.59 | 6 | | | |
| 50418 | 5 | 23 | 10 | 9 | 2128.59 | 2115.46 | 8 | | | |
| 50418 | 6 | 17 | 10 | 10 | 2211.14 | 2197.63 | 8 | | | |
| 50418 | 7 | 47 | 10 | 9 | 2226.28 | 2208.7 | 9 | | | |
| 50418 | 8 | 69 | 10 | 8 | 2232.01 | 2221.08 | 5 | | | |
| 50419 | 1 | 90 | 10 | 10 | 2137.6 | 2122.86 | 10 | | | |
| 50419 | 2 | 54 | 10 | 10 | 2075.08 | 2058.74 | 10 | | | |
| 50419 | 3 | 68 | 10 | 9 | 2203.29 | 2187.15 | 9 | | | |
| 50419 | 4 | 118 | 10 | 8 | 2156.5 | 2143.12 | 7 | | | |
| 50419 | 5 | 81 | 10 | 10 | 2220.4 | 2207.35 | 10 | | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 12 | 10 | 9 | 2207.66 | 2193.91 | 8 | | | |
| 50419 | 7 | 43 | 10 | 10 | 2197.41 | 2185.23 | 8 | | | |
| 50419 | 8 | 2 | 10 | 8 | 2235.22 | 2224.79 | 6 | | | |
| 50420 | 1 | 109 | 10 | 10 | 2198.79 | 2180.89 | 10 | | | |
| 50420 | 2 | 88 | 10 | 8 | 2222.76 | 2211.32 | 6 | | | |
| 50420 | 3 | 39 | 10 | 9 | 2180.75 | 2167.6 | 7 | | | |
| 50420 | 4 | 51 | 10 | 7 | 2474.78 | 2459.82 | 6 | | | |
| 50420 | 5 | 34 | 10 | 10 | 2157.79 | 2146.15 | 7 | | | |
| 50420 | 6 | 52 | 10 | 10 | 2124.4 | 2111.22 | 8 | | | |
| 50420 | 7 | 14 | 10 | 8 | 2127.79 | 2114.35 | 7 | | | |
| 50420 | 8 | 71 | 10 | 10 | 2134.34 | 2117.45 | 9 | | | |
| 50421 | 1 | 76 | 10 | 10 | 2039.98 | 2024.45 | 8 | | | |
| 50421 | 2 | 110 | 10 | 10 | 2243.29 | 2228.16 | 9 | | | |
| 50421 | 3 | 127 | 10 | 8 | 2191.22 | 2178.52 | 7 | | | |
| 50421 | 4 | 80 | 10 | 10 | 2128.78 | 2114.79 | 8 | | | |
| 50421 | 5 | 29 | 10 | 9 | 2140.17 | 2128.31 | 7 | | | |
| 50421 | 6 | 55 | 10 | 10 | 2120.11 | 2103.95 | 9 | | | |
| 50421 | 7 | 87 | 10 | 10 | 2199.8 | 2185.26 | 8 | | | |
| 50421 | 8 | 65 | 10 | 8 | 2219.81 | 2205.45 | 8 | | | |
| 50422 | 1 | 63 | 10 | 10 | 2161.55 | 2145.53 | 9 | | | |
| 50422 | 2 | 46 | 10 | 8 | 2297.93 | 2285.49 | 7 | | | |
| 50422 | 3 | 10 | 10 | 8 | 2083.43 | 2069.21 | 7 | | | |
| 50422 | 4 | 45 | 10 | 10 | 2035.97 | 2024.78 | 7 | | | |
| 50422 | 5 | 113 | 10 | 9 | 2208.11 | 2196.89 | 6 | | | |
| 50422 | 6 | 72 | 10 | 10 | 2214.72 | 2200.73 | 7 | | | |
| 50422 | 7 | 89 | 10 | 10 | 2162.86 | 2149.53 | 8 | | | |
| 50422 | 8 | 70 | 10 | 9 | 2321.46 | 2309.51 | 6 | | | |
| 50423 | 1 | 95 | 10 | 7 | 2544.52 | 2535.91 | 4 | | | |
| 50423 | 2 | 123 | 10 | 7 | 2219.01 | 2205.81 | 6 | | | |
| 50423 | 3 | 41 | 10 | 9 | 2204.08 | 2190.81 | 8 | | | |
| 50423 | 4 | 128 | 10 | 9 | 2259.73 | 2246.28 | 9 | | | |
| 50423 | 5 | 77 | 10 | 10 | 2066.62 | 2050.05 | 10 | | | |
| 50423 | 6 | 99 | 10 | 9 | 2143.49 | 2125.5 | 9 | | | |
| 50423 | 7 | 79 | 10 | 10 | 2207.57 | 2195.3 | 7 | | | |
| 50423 | 8 | 103 | 10 | 9 | 2129.45 | 2121.78 | 3 | | | |
| 50424 | 1 | 60 | 10 | 9 | 2190.71 | 2178.87 | 7 | | | |
| 50424 | 2 | 74 | 10 | 8 | 2174.42 | 2161.76 | 7 | | | |
| 50424 | 3 | 85 | 10 | 10 | 2108.99 | 2096.47 | 9 | | | |
| 50424 | 4 | 108 | 10 | 9 | 2449.83 | 2438.53 | 7 | | | |
| 50424 | 5 | 119 | 10 | 7 | 2267.91 | 2258.05 | 5 | | | |
| 50424 | 6 | 44 | 10 | 9 | 2081.98 | 2071.02 | 6 | | | |
| 50424 | 7 | 31 | 10 | 8 | 2261.58 | 2248.59 | 7 | | | |
| 50424 | 8 | 33 | 10 | 10 | 2228.99 | 2212.83 | 10 | | | |
| 50425 | 1 | 38 | 10 | 9 | 2119.13 | 2106.53 | 7 | | | |
| 50425 | 2 | 100 | 10 | 10 | 2240.25 | 2227.55 | 7 | | | |
| 50425 | 3 | 28 | 10 | 9 | 2214.27 | 2202.56 | 7 | | | |
| 50425 | 4 | 106 | 10 | 8 | 2139.09 | 2126.93 | 6 | | | |
| 50425 | 5 | 125 | 10 | 9 | 2309.43 | 2295.66 | 8 | | | |
| 50425 | 6 | 21 | 10 | 9 | 2227.23 | 2215.05 | 7 | | | |
| 50425 | 7 | 8 | 10 | 7 | 2164.29 | 2159.13 | 2 | | | |

## CETIS Test Data Worksheet

**Report Date:** 08 Sep-17 14:42 (p 3 of 3)
**Test Code/ID:** 12-9251-9486/80704 (D)

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 5 | 10 | 10 | 2163.2 | 2149.99 | 8 | | | |
| 50426 | 1 | 92 | 10 | 9 | 2226.31 | 2213.52 | 8 | | | |
| 50426 | 2 | 116 | 10 | 7 | 2354.81 | 2340.68 | 7 | | | |
| 50426 | 3 | 75 | 10 | 9 | 2231.22 | 2218.04 | 8 | | | |
| 50426 | 4 | 53 | 10 | 8 | 2444.87 | 2433.46 | 6 | | | |
| 50426 | 5 | 24 | 10 | 7 | 2390.31 | 2379.17 | 5 | | | |
| 50426 | 6 | 107 | 10 | 7 | 2362.15 | 2350.34 | 6 | | | |
| 50426 | 7 | 111 | 10 | 10 | 2343.96 | 2331.77 | 9 | | | |
| 50426 | 8 | 105 | 10 | 9 | 2407.34 | 2396.27 | 7 | | | |
| 50427 | 1 | 102 | 10 | 8 | 2476.02 | 2467.02 | 4 | | | |
| 50427 | 2 | 96 | 10 | 6 | 2366.13 | 2356.99 | 4 | | | |
| 50427 | 3 | 30 | 10 | 8 | 2428.5 | 2413.79 | 7 | | | |
| 50427 | 4 | 36 | 10 | 9 | 2373.14 | 2360.36 | 6 | | | |
| 50427 | 5 | 94 | 10 | 10 | 2343.17 | 2325.07 | 10 | | | |
| 50427 | 6 | 59 | 10 | 10 | 2273.99 | 2261.18 | 8 | | | |
| 50427 | 7 | 115 | 10 | 7 | 2364.6 | 2355.23 | 5 | | | |
| 50427 | 8 | 101 | 10 | 10 | 2223.49 | 2210.73 | 8 | | | |
| 50428 | 1 | 20 | 10 | 10 | 2391.69 | 2377.49 | 8 | | | |
| 50428 | 2 | 50 | 10 | 8 | 2155.16 | 2142.61 | 6 | | | |
| 50428 | 3 | 32 | 10 | 10 | 2183.72 | 2168.43 | 9 | | | |
| 50428 | 4 | 66 | 10 | 8 | 2274.73 | 2264.08 | 6 | | | |
| 50428 | 5 | 86 | 10 | 8 | 2493.86 | 2484.17 | 5 | | | |
| 50428 | 6 | 6 | 10 | 8 | 2350.13 | 2334.55 | 8 | | | |
| 50428 | 7 | 122 | 10 | 8 | 2337.99 | 2323.78 | 7 | | | |
| 50428 | 8 | 58 | 10 | 10 | 2189.29 | 2171.95 | 10 | | | |
| 50429 | 1 | 82 | 10 | 9 | 2281.62 | 2266.05 | 8 | | | |
| 50429 | 2 | 121 | 10 | 9 | 2443.35 | 2429.48 | 7 | | | |
| 50429 | 3 | 78 | 10 | 8 | 2242.71 | 2230.96 | 6 | | | |
| 50429 | 4 | 124 | 10 | 10 | 2247.5 | 2229.58 | 10 | | | |
| 50429 | 5 | 93 | 10 | 10 | 2390.01 | 2374.08 | 9 | | | |
| 50429 | 6 | 22 | 10 | 7 | 2362.13 | 2353.08 | 5 | | | |
| 50429 | 7 | 37 | 10 | 8 | 2413.47 | 2404.32 | 5 | | | |
| 50429 | 8 | 48 | 10 | 10 | 2306.54 | 2290.94 | 8 | | | |

*Chironomus dilutus*

10-day survival and

growth test (ash-free dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1900N

(Aquatec Sample # 50433)

STATISTICAL COMPARISONS TO 50433
(SEDBACK-1400N)

## CETIS Summary Report



**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 11-1986-8050 | **Test Type:** | Survival-AF Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 01 Aug-17 19:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 11 Aug-17 16:45 | **Species:** | Chironomus dilutus | **Brine:** | |
| **Duration:** | 9d 21h | **Source:** | Aquatic Biosystems, CO | **Age:** | |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 08-1189-2807 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1273 | 50415 passed mean af weight-mg |
| 11-1678-7989 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1081 | 50416 passed mean af weight-mg |
| 15-7138-0713 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0019 | 50417 failed mean af weight-mg |
| 16-5367-4991 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.3649 | 50418 passed mean af weight-mg |
| 08-1480-8161 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0420 | 50419 failed mean af weight-mg |
| 04-5403-2361 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.4506 | 50420 passed mean af weight-mg |
| 00-2644-6221 | Mean AF Weight-mg | Unequal Variance t Two-Sample Test | 0.1846 | 50421 passed mean af weight-mg |
| 16-6580-8468 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.2995 | 50422 passed mean af weight-mg |
| 19-0140-9749 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.5347 | 50423 passed mean af weight-mg |
| 09-5538-7144 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1047 | 50424 passed mean af weight-mg |
| 04-5780-5211 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.4061 | 50425 passed mean af weight-mg |
| 19-1654-4876 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.2258 | 50426 passed mean af weight-mg |
| 19-9382-2410 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.5896 | 50427 passed mean af weight-mg |
| 01-7068-9348 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.3825 | 50428 passed mean af weight-mg |
| 07-1826-6917 | Mean AF Weight-mg | Unequal Variance t Two-Sample Test | 0.3956 | 50429 passed mean af weight-mg |
| 07-1676-7296 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5653 | 50415 passed survival rate |
| 01-1565-8993 | Survival Rate | Equal Variance t Two-Sample Test | 0.1588 | 50416 passed survival rate |
| 03-9712-9100 | Survival Rate | Equal Variance t Two-Sample Test | 0.3471 | 50417 passed survival rate |
| 11-5108-6116 | Survival Rate | Equal Variance t Two-Sample Test | 0.2529 | 50418 passed survival rate |
| 12-7165-8866 | Survival Rate | Equal Variance t Two-Sample Test | 0.6191 | 50419 passed survival rate |
| 10-4193-1952 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50420 passed survival rate |
| 03-1424-1397 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7154 | 50421 passed survival rate |
| 15-4250-4204 | Survival Rate | Equal Variance t Two-Sample Test | 0.6191 | 50422 passed survival rate |
| 05-0655-1420 | Survival Rate | Equal Variance t Two-Sample Test | 0.3141 | 50423 passed survival rate |
| 09-6830-3649 | Survival Rate | Equal Variance t Two-Sample Test | 0.2958 | 50424 passed survival rate |
| 12-1287-5845 | Survival Rate | Equal Variance t Two-Sample Test | 0.3661 | 50425 passed survival rate |
| 12-0733-0055 | Survival Rate | Equal Variance t Two-Sample Test | 0.1079 | 50426 passed survival rate |
| 14-8852-6398 | Survival Rate | Equal Variance t Two-Sample Test | 0.2404 | 50427 passed survival rate |
| 14-1181-7002 | Survival Rate | Equal Variance t Two-Sample Test | 0.2978 | 50428 passed survival rate |
| 12-8839-0248 | Survival Rate | Equal Variance t Two-Sample Test | 0.3840 | 50429 passed survival rate |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

### Mean AF Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 1.918 | 1.601 | 2.235 | 1.422 | 2.552 | 0.134 | 0.3791 | 19.77% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.38 | 2.088 | 0.06959 | 0.1968 | 11.32% | 9.36% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.544 | 1.921 | 0.05377 | 0.1521 | 8.79% | 9.75% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.156 | 1.712 | 0.06052 | 0.1712 | 12.15% | 26.53% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.641 | 2.186 | 0.06328 | 0.179 | 9.59% | 2.72% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.305 | 1.911 | 0.069 | 0.1952 | 11.92% | 14.62% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.647 | 2.493 | 0.09311 | 0.2634 | 13.88% | 1.08% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.681 | 1.941 | 0.02893 | 0.08183 | 4.58% | 6.86% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.599 | 2.031 | 0.05696 | 0.1611 | 8.76% | 4.09% |
| 50423 | | 8 | 1.934 | 1.636 | 2.232 | 1.494 | 2.557 | 0.126 | 0.3564 | 18.43% | -0.85% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.391 | 1.972 | 0.06438 | 0.1821 | 10.57% | 10.20% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.651 | 2.58 | 0.1087 | 0.3076 | 16.40% | 2.18% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.354 | 2.228 | 0.1016 | 0.2875 | 16.08% | 6.79% |
| 50427 | | 8 | 1.956 | 1.726 | 2.186 | 1.595 | 2.285 | 0.09731 | 0.2752 | 14.07% | -1.99% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.699 | 2.092 | 0.05194 | 0.1469 | 7.84% | 2.29% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.77 | 1.981 | 0.03076 | 0.08699 | 4.63% | 1.97% |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 0.9000 | 0.7818 | 1.0000 | 0.6000 | 1.0000 | 0.0500 | 0.1414 | 15.71% | 0.00% |
| 50415 | | 8 | 0.9125 | 0.8184 | 1.0000 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.34% | -1.39% |
| 50416 | | 8 | 0.8500 | 0.7726 | 0.9274 | 0.7000 | 1.0000 | 0.0327 | 0.0926 | 10.89% | 5.56% |
| 50417 | | 8 | 0.8875 | 0.8177 | 0.9573 | 0.8000 | 1.0000 | 0.0295 | 0.0835 | 9.40% | 1.39% |
| 50418 | | 8 | 0.8750 | 0.8159 | 0.9341 | 0.8000 | 1.0000 | 0.0250 | 0.0707 | 8.08% | 2.78% |
| 50419 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -2.78% |
| 50420 | | 8 | 0.9000 | 0.8001 | 0.9999 | 0.7000 | 1.0000 | 0.0423 | 0.1195 | 13.28% | 0.00% |
| 50421 | | 8 | 0.9375 | 0.8609 | 1.0000 | 0.8000 | 1.0000 | 0.0324 | 0.0916 | 9.77% | -4.17% |
| 50422 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -2.78% |
| 50423 | | 8 | 0.8750 | 0.7776 | 0.9724 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 13.31% | 2.78% |
| 50424 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.7000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | 2.78% |
| 50425 | | 8 | 0.8875 | 0.8046 | 0.9704 | 0.7000 | 1.0000 | 0.0350 | 0.0991 | 11.17% | 1.39% |
| 50426 | | 8 | 0.8250 | 0.7276 | 0.9224 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 14.12% | 8.33% |
| 50427 | | 8 | 0.8500 | 0.7236 | 0.9764 | 0.6000 | 1.0000 | 0.0535 | 0.1512 | 17.79% | 5.56% |
| 50428 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.8000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | 2.78% |
| 50429 | | 8 | 0.8875 | 0.7934 | 0.9816 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.69% | 1.39% |

# CETIS Analytical Report

| | | | |
|---|---|---|---|
| | | Report Date: | 08 Sep-17 15:32 (p 1 of 1) |
| | | Test Code: | 80705 (E) \| 18-1182-4298 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 15-7138-0713 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:28 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50433 | 04-7977-3241 | 13 Jun-17 08:00 | 15 Jun-17 16:35 | 49d 11h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 55d 7h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50433 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1900N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean af weight-mg | 13.51% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 3.459 | 1.761 | 0.259 | 14 | CDF | 0.0019 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.03528 | 1.03528 | 1 | 11.96 | 0.0038 | Significant Effect |
| Error | 1.2114 | 0.0865283 | 14 | | | |
| Total | 2.24668 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 4.905 | 8.885 | 0.0524 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.96 | 0.8408 | 0.6613 | Normal Distribution |

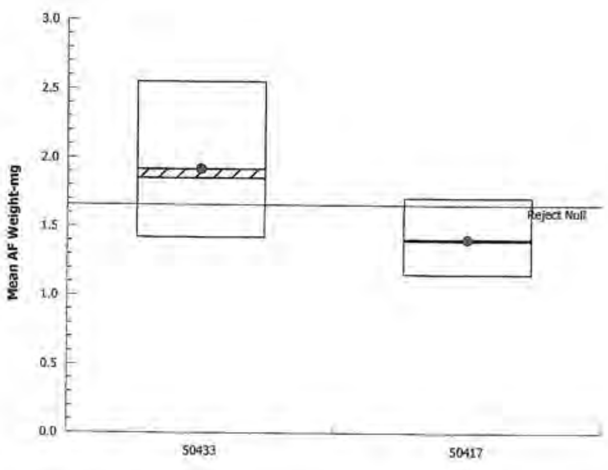
### Mean AF Weight-mg Summary

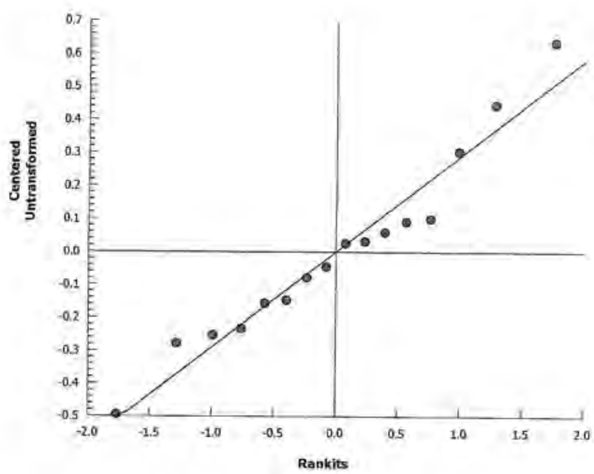
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 1.918 | 1.601 | 2.235 | 1.852 | 1.422 | 2.552 | 0.134 | 19.77% | 0.00% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.402 | 1.156 | 1.712 | 0.06052 | 12.15% | 26.53% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 1.943 | 1.422 | 1.684 | 1.977 | 1.76 | 1.64 | 2.362 | 2.552 |
| 50417 | | 1.509 | 1.5 | 1.261 | 1.712 | 1.33 | 1.156 | 1.363 | 1.44 |

### Graphics






Analyst: JW QA: 9/10/17

# CETIS Analytical Report

| | |
|---|---|
| Report Date: | 08 Sep-17 15:32 (p 1 of 1) |
| Test Code: | 80705 (E) \| 18-1182-4298 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-1480-8161 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:28 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50433 | 04-7977-3241 | 13 Jun-17 08:00 | 15 Jun-17 16:35 | 49d 11h | AECOM (MA) | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 54d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50433 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1900N | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean af weight-mg | 13.85% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50419* | 1.86 | 1.761 | 0.266 | 14 | CDF | 0.0420 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.314555 | 0.314555 | 1 | 3.46 | 0.0840 | Non-Significant Effect |
| Error | 1.27288 | 0.0909198 | 14 | | | |
| Total | 1.58743 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.774 | 8.885 | 0.1008 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9762 | 0.8408 | 0.9261 | Normal Distribution |

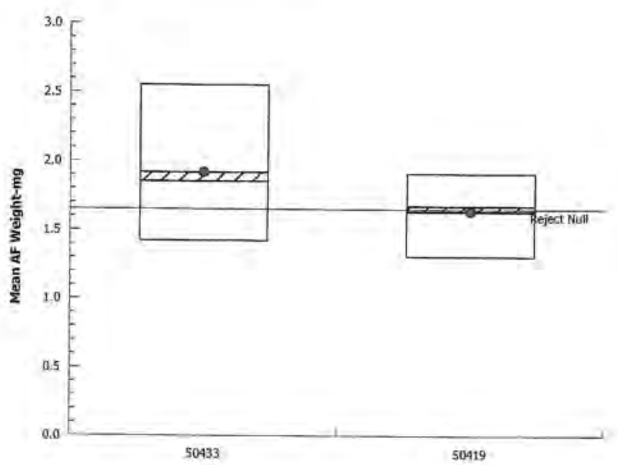
**Mean AF Weight-mg Summary**

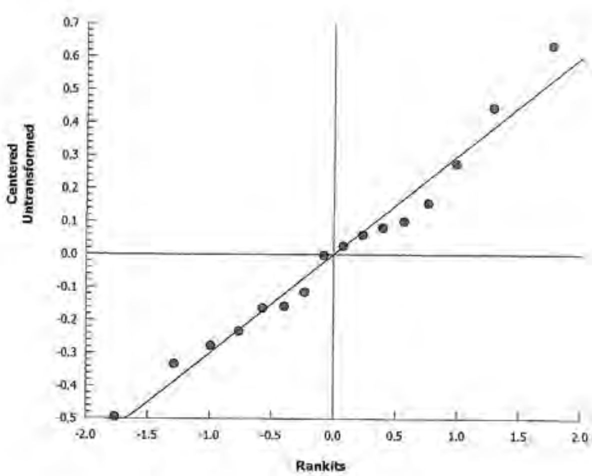
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 1.918 | 1.601 | 2.235 | 1.852 | 1.422 | 2.552 | 0.134 | 19.77% | 0.00% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.676 | 1.305 | 1.911 | 0.069 | 11.92% | 14.62% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 1.943 | 1.422 | 1.684 | 1.977 | 1.76 | 1.64 | 2.362 | 2.552 |
| 50419 | | 1.474 | 1.634 | 1.793 | 1.911 | 1.305 | 1.719 | 1.522 | 1.738 |

**Graphics**



# CETIS Test Data Worksheet

Report Date: 08 Sep-17 15:28 (p 1 of 3)
Test Code/ID: 18-1182-4298/80705 (E)

**Chironomus 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| | | | | | |
|---|---|---|---|---|---|
| **Start Date:** | 01 Aug-17 19:30 | **Species:** | Chironomus dilutus | **Sample Code:** | 50433 |
| **End Date:** | 11 Aug-17 16:45 | **Protocol:** | EPA/600/R-99/064 (2000) | **Sample Source:** | PEPCO Benning Rd-Waterside Inve |
| **Sample Date:** | 13 Jun-17 08:00 | **Material:** | Reference sediment | **Sample Station:** | SEDBACK1900N |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | 1 | 68 | 10 | 11 | 2359.92 | 2342.43 | 9 | | | |
| 50433 | 2 | 47 | 10 | 11 | 2313.94 | 2302.56 | 8 | | | |
| 50433 | 3 | 62 | 10 | 10 | 2350.41 | 2336.94 | 8 | | | |
| 50433 | 4 | 19 | 10 | 10 | 2307.9 | 2290.11 | 9 | | | |
| 50433 | 5 | 7 | 10 | 9 | 2465.03 | 2449.19 | 9 | | | |
| 50433 | 6 | 64 | 10 | 9 | 2385.83 | 2372.71 | 8 | | | |
| 50433 | 7 | 123 | 10 | 8 | 2238.99 | 2229.54 | 4 | | | |
| 50433 | 8 | 101 | 10 | 6 | 2295.71 | 2282.95 | 5 | | | |
| 50415 | 1 | 21 | 10 | 9 | 2299.25 | 2286.92 | 7 | | | |
| 50415 | 2 | 72 | 10 | 9 | 2339.95 | 2325.75 | 8 | | | |
| 50415 | 3 | 16 | 10 | 10 | 2295.3 | 2284.82 | 6 | | | |
| 50415 | 4 | 8 | 10 | 8 | 2405.82 | 2393.04 | 7 | | | |
| 50415 | 5 | 6 | 10 | 7 | 2498.95 | 2488.51 | 5 | | | |
| 50415 | 6 | 117 | 10 | 10 | 2278.14 | 2268.15 | 6 | | | |
| 50415 | 7 | 43 | 10 | 10 | 2397.55 | 2387.89 | 7 | | | |
| 50415 | 8 | 33 | 10 | 10 | 2444.03 | 2430.72 | 8 | | | |
| 50416 | 1 | 82 | 10 | 8 | 2462.55 | 2449.1 | 7 | | | |
| 50416 | 2 | 18 | 10 | 10 | 2324.27 | 2307.53 | 10 | | | |
| 50416 | 3 | 70 | 10 | 9 | 2399.91 | 2384.98 | 9 | | | |
| 50416 | 4 | 71 | 10 | 9 | 2398.18 | 2384.28 | 9 | | | |
| 50416 | 5 | 118 | 10 | 8 | 2231.44 | 2220.49 | 7 | | | |
| 50416 | 6 | 60 | 10 | 9 | 2437.69 | 2425.83 | 7 | | | |
| 50416 | 7 | 4 | 10 | 7 | 2322.69 | 2309.34 | 7 | | | |
| 50416 | 8 | 76 | 10 | 8 | 2316.59 | 2305.31 | 6 | | | |
| 50417 | 1 | 10 | 10 | 8 | 2178.96 | 2166.89 | 8 | | | |
| 50417 | 2 | 127 | 10 | 9 | 2164.7 | 2152.7 | 8 | | | |
| 50417 | 3 | 32 | 10 | 9 | 2115.26 | 2106.43 | 7 | | | |
| 50417 | 4 | 1 | 10 | 8 | 2199.69 | 2189.42 | 6 | | | |
| 50417 | 5 | 23 | 10 | 10 | 2266.87 | 2253.57 | 10 | | | |
| 50417 | 6 | 81 | 10 | 10 | 2153.9 | 2143.5 | 9 | | | |
| 50417 | 7 | 57 | 10 | 9 | 2047.12 | 2034.85 | 9 | | | |
| 50417 | 8 | 35 | 10 | 8 | 2179.02 | 2168.94 | 7 | | | |
| 50418 | 1 | 58 | 10 | 8 | 2172.05 | 2160.19 | 6 | | | |
| 50418 | 2 | 50 | 10 | 8 | 2198.71 | 2185.35 | 7 | | | |
| 50418 | 3 | 14 | 10 | 9 | 2078.14 | 2061.64 | 9 | | | |
| 50418 | 4 | 38 | 10 | 9 | 2208 | 2197.59 | 6 | | | |
| 50418 | 5 | 73 | 10 | 9 | 2128.59 | 2115.46 | 8 | | | |
| 50418 | 6 | 74 | 10 | 10 | 2211.14 | 2197.63 | 8 | | | |
| 50418 | 7 | 100 | 10 | 9 | 2226.28 | 2208.7 | 9 | | | |
| 50418 | 8 | 102 | 10 | 8 | 2232.01 | 2221.08 | 5 | | | |
| 50419 | 1 | 97 | 10 | 10 | 2137.6 | 2122.86 | 10 | | | |
| 50419 | 2 | 128 | 10 | 10 | 2075.08 | 2058.74 | 10 | | | |
| 50419 | 3 | 54 | 10 | 9 | 2203.29 | 2187.15 | 9 | | | |
| 50419 | 4 | 63 | 10 | 8 | 2156.5 | 2143.12 | 7 | | | |
| 50419 | 5 | 98 | 10 | 10 | 2220.4 | 2207.35 | 10 | | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 99 | 10 | 9 | 2207.66 | 2193.91 | 8 | | | |
| 50419 | 7 | 45 | 10 | 10 | 2197.41 | 2185.23 | 8 | | | |
| 50419 | 8 | 94 | 10 | 8 | 2235.22 | 2224.79 | 6 | | | |
| 50420 | 1 | 28 | 10 | 10 | 2198.79 | 2180.89 | 10 | | | |
| 50420 | 2 | 109 | 10 | 8 | 2222.76 | 2211.32 | 6 | | | |
| 50420 | 3 | 44 | 10 | 9 | 2180.75 | 2167.6 | 7 | | | |
| 50420 | 4 | 56 | 10 | 7 | 2474.78 | 2459.82 | 6 | | | |
| 50420 | 5 | 120 | 10 | 10 | 2157.79 | 2146.15 | 7 | | | |
| 50420 | 6 | 90 | 10 | 10 | 2124.4 | 2111.22 | 8 | | | |
| 50420 | 7 | 48 | 10 | 8 | 2127.79 | 2114.35 | 7 | | | |
| 50420 | 8 | 69 | 10 | 10 | 2134.34 | 2117.45 | 9 | | | |
| 50421 | 1 | 85 | 10 | 10 | 2039.98 | 2024.45 | 8 | | | |
| 50421 | 2 | 103 | 10 | 10 | 2243.29 | 2228.16 | 9 | | | |
| 50421 | 3 | 30 | 10 | 8 | 2191.22 | 2178.52 | 7 | | | |
| 50421 | 4 | 77 | 10 | 10 | 2128.78 | 2114.79 | 8 | | | |
| 50421 | 5 | 78 | 10 | 9 | 2140.17 | 2128.31 | 7 | | | |
| 50421 | 6 | 34 | 10 | 10 | 2120.11 | 2103.95 | 9 | | | |
| 50421 | 7 | 122 | 10 | 10 | 2199.8 | 2185.26 | 8 | | | |
| 50421 | 8 | 110 | 10 | 8 | 2219.81 | 2205.45 | 8 | | | |
| 50422 | 1 | 13 | 10 | 10 | 2161.55 | 2145.53 | 9 | | | |
| 50422 | 2 | 93 | 10 | 8 | 2297.93 | 2285.49 | 7 | | | |
| 50422 | 3 | 31 | 10 | 8 | 2083.43 | 2069.21 | 7 | | | |
| 50422 | 4 | 106 | 10 | 10 | 2035.97 | 2024.78 | 7 | | | |
| 50422 | 5 | 20 | 10 | 9 | 2208.11 | 2196.89 | 6 | | | |
| 50422 | 6 | 105 | 10 | 10 | 2214.72 | 2200.73 | 7 | | | |
| 50422 | 7 | 25 | 10 | 10 | 2162.86 | 2149.53 | 8 | | | |
| 50422 | 8 | 112 | 10 | 9 | 2321.46 | 2309.51 | 6 | | | |
| 50423 | 1 | 9 | 10 | 7 | 2544.52 | 2535.91 | 4 | | | |
| 50423 | 2 | 67 | 10 | 7 | 2219.01 | 2205.81 | 6 | | | |
| 50423 | 3 | 119 | 10 | 9 | 2204.08 | 2190.81 | 8 | | | |
| 50423 | 4 | 116 | 10 | 9 | 2259.73 | 2246.28 | 9 | | | |
| 50423 | 5 | 126 | 10 | 10 | 2066.62 | 2050.05 | 10 | | | |
| 50423 | 6 | 83 | 10 | 9 | 2143.49 | 2125.5 | 9 | | | |
| 50423 | 7 | 108 | 10 | 10 | 2207.57 | 2195.3 | 7 | | | |
| 50423 | 8 | 39 | 10 | 9 | 2129.45 | 2121.78 | 3 | | | |
| 50424 | 1 | 49 | 10 | 9 | 2190.71 | 2178.87 | 7 | | | |
| 50424 | 2 | 51 | 10 | 8 | 2174.42 | 2161.76 | 7 | | | |
| 50424 | 3 | 114 | 10 | 10 | 2108.99 | 2096.47 | 9 | | | |
| 50424 | 4 | 87 | 10 | 9 | 2449.83 | 2438.53 | 7 | | | |
| 50424 | 5 | 124 | 10 | 7 | 2267.91 | 2258.05 | 5 | | | |
| 50424 | 6 | 88 | 10 | 9 | 2081.98 | 2071.02 | 6 | | | |
| 50424 | 7 | 121 | 10 | 8 | 2261.58 | 2248.59 | 7 | | | |
| 50424 | 8 | 37 | 10 | 10 | 2228.99 | 2212.83 | 10 | | | |
| 50425 | 1 | 79 | 10 | 9 | 2119.13 | 2106.53 | 7 | | | |
| 50425 | 2 | 80 | 10 | 10 | 2240.25 | 2227.55 | 7 | | | |
| 50425 | 3 | 55 | 10 | 9 | 2214.27 | 2202.56 | 7 | | | |
| 50425 | 4 | 11 | 10 | 8 | 2139.09 | 2126.93 | 6 | | | |
| 50425 | 5 | 107 | 10 | 9 | 2309.43 | 2295.66 | 8 | | | |
| 50425 | 6 | 2 | 10 | 9 | 2227.23 | 2215.05 | 7 | | | |
| 50425 | 7 | 84 | 10 | 7 | 2164.29 | 2159.13 | 2 | | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 95 | 10 | 10 | 2163.2 | 2149.99 | 8 | | | |
| 50426 | 1 | 41 | 10 | 9 | 2226.31 | 2213.52 | 8 | | | |
| 50426 | 2 | 42 | 10 | 7 | 2354.81 | 2340.68 | 7 | | | |
| 50426 | 3 | 65 | 10 | 9 | 2231.22 | 2218.04 | 8 | | | |
| 50426 | 4 | 53 | 10 | 8 | 2444.87 | 2433.46 | 6 | | | |
| 50426 | 5 | 29 | 10 | 7 | 2390.31 | 2379.17 | 5 | | | |
| 50426 | 6 | 86 | 10 | 7 | 2362.15 | 2350.34 | 6 | | | |
| 50426 | 7 | 111 | 10 | 10 | 2343.96 | 2331.77 | 9 | | | |
| 50426 | 8 | 66 | 10 | 9 | 2407.34 | 2396.27 | 7 | | | |
| 50427 | 1 | 3 | 10 | 8 | 2476.02 | 2467.02 | 4 | | | |
| 50427 | 2 | 12 | 10 | 6 | 2366.13 | 2356.99 | 4 | | | |
| 50427 | 3 | 125 | 10 | 8 | 2428.5 | 2413.79 | 7 | | | |
| 50427 | 4 | 24 | 10 | 9 | 2373.14 | 2360.36 | 6 | | | |
| 50427 | 5 | 15 | 10 | 10 | 2343.17 | 2325.07 | 10 | | | |
| 50427 | 6 | 92 | 10 | 10 | 2273.99 | 2261.18 | 8 | | | |
| 50427 | 7 | 104 | 10 | 7 | 2364.6 | 2355.23 | 5 | | | |
| 50427 | 8 | 52 | 10 | 10 | 2223.49 | 2210.73 | 8 | | | |
| 50428 | 1 | 59 | 10 | 10 | 2391.69 | 2377.49 | 8 | | | |
| 50428 | 2 | 115 | 10 | 8 | 2155.16 | 2142.61 | 6 | | | |
| 50428 | 3 | 40 | 10 | 10 | 2183.72 | 2168.43 | 9 | | | |
| 50428 | 4 | 26 | 10 | 8 | 2274.73 | 2264.08 | 6 | | | |
| 50428 | 5 | 113 | 10 | 8 | 2493.86 | 2484.17 | 5 | | | |
| 50428 | 6 | 17 | 10 | 8 | 2350.13 | 2334.55 | 8 | | | |
| 50428 | 7 | 61 | 10 | 8 | 2337.99 | 2323.78 | 7 | | | |
| 50428 | 8 | 89 | 10 | 10 | 2189.29 | 2171.95 | 10 | | | |
| 50429 | 1 | 22 | 10 | 9 | 2281.62 | 2266.05 | 8 | | | |
| 50429 | 2 | 96 | 10 | 9 | 2443.35 | 2429.48 | 7 | | | |
| 50429 | 3 | 46 | 10 | 8 | 2242.71 | 2230.96 | 6 | | | |
| 50429 | 4 | 36 | 10 | 10 | 2247.5 | 2229.58 | 10 | | | |
| 50429 | 5 | 75 | 10 | 10 | 2390.01 | 2374.08 | 9 | | | |
| 50429 | 6 | 5 | 10 | 7 | 2362.13 | 2353.08 | 5 | | | |
| 50429 | 7 | 27 | 10 | 8 | 2413.47 | 2404.32 | 5 | | | |
| 50429 | 8 | 91 | 10 | 10 | 2306.54 | 2290.94 | 8 | | | |

*Chironomus dilutus*

10-day survival and

growth test (ash-free dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK2000N

(Aquatec Sample # 50434)

STATISTICAL COMPARISONS TO 50484 (SEDBACK-2000N)

## CETIS Summary Report

Report Date: 08 Sep-17 15:37 (p 1 of 2)
Test Code: 80706 (F) | 20-9205-6997

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 11-1986-8050 | **Test Type:** | Survival-AF Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 01 Aug-17 19:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 11 Aug-17 16:45 | **Species:** | Chironomus dilutus | **Brine:** | |
| **Duration:** | 9d 21h | **Source:** | Aquatic Biosystems, CO | **Age:** | |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 02-7278-8673 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0051 | 50415 failed mean af weight-mg |
| 08-3008-2505 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0028 | 50416 failed mean af weight-mg |
| 14-1628-3586 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 1.6E-05 | 50417 failed mean af weight-mg |
| 07-3978-4874 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0361 | 50418 failed mean af weight-mg |
| 08-0609-0932 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 9.2E-04 | 50419 failed mean af weight-mg |
| 12-0386-9864 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.0415 | 50420 failed mean af weight-mg |
| 13-1592-4748 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 5.4E-04 | 50421 failed mean af weight-mg |
| 00-7069-2635 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0210 | 50422 failed mean af weight-mg |
| 14-7867-4589 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1732 | 50423 passed mean af weight-mg |
| 05-5676-0764 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0033 | 50424 failed mean af weight-mg |
| 19-1201-0269 | Mean AF Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.0141 | 50425 failed mean af weight-mg |
| 08-9215-9226 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0245 | 50426 failed mean af weight-mg |
| 17-2895-0114 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.1745 | 50427 passed mean af weight-mg |
| 10-8407-0040 | Mean AF Weight-mg | Equal Variance t Two-Sample Test | 0.0343 | 50428 failed mean af weight-mg |
| 03-8967-0517 | Mean AF Weight-mg | Unequal Variance t Two-Sample Test | 0.0357 | 50429 failed mean af weight-mg |
| 12-9251-3108 | Survival Rate | Equal Variance t Two-Sample Test | 0.8492 | 50415 passed survival rate |
| 16-5454-4288 | Survival Rate | Equal Variance t Two-Sample Test | 0.4593 | 50416 passed survival rate |
| 13-9085-0675 | Survival Rate | Equal Variance t Two-Sample Test | 0.7212 | 50417 passed survival rate |
| 05-5516-8364 | Survival Rate | Equal Variance t Two-Sample Test | 0.6331 | 50418 passed survival rate |
| 13-8616-0709 | Survival Rate | Equal Variance t Two-Sample Test | 0.9006 | 50419 passed survival rate |
| 17-8104-2267 | Survival Rate | Equal Variance t Two-Sample Test | 0.7897 | 50420 passed survival rate |
| 11-6842-5322 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9417 | 50421 passed survival rate |
| 01-5252-1473 | Survival Rate | Equal Variance t Two-Sample Test | 0.9006 | 50422 passed survival rate |
| 00-5941-5688 | Survival Rate | Equal Variance t Two-Sample Test | 0.6548 | 50423 passed survival rate |
| 02-7732-6889 | Survival Rate | Equal Variance t Two-Sample Test | 0.6457 | 50424 passed survival rate |
| 16-9241-3169 | Survival Rate | Equal Variance t Two-Sample Test | 0.7268 | 50425 passed survival rate |
| 18-9932-9163 | Survival Rate | Equal Variance t Two-Sample Test | 0.3295 | 50426 passed survival rate |
| 16-4601-8761 | Survival Rate | Equal Variance t Two-Sample Test | 0.5219 | 50427 passed survival rate |
| 06-8676-9642 | Survival Rate | Equal Variance t Two-Sample Test | 0.6392 | 50428 passed survival rate |
| 15-9702-1781 | Survival Rate | Equal Variance t Two-Sample Test | 0.7245 | 50429 passed survival rate |

### Mean AF Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 1.839 | 2.67 | 0.09531 | 0.2696 | 12.91% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.38 | 2.088 | 0.06959 | 0.1968 | 11.32% | 16.75% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.544 | 1.921 | 0.05377 | 0.1521 | 8.79% | 17.11% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.156 | 1.712 | 0.06052 | 0.1712 | 12.15% | 32.52% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.641 | 2.186 | 0.06328 | 0.179 | 9.59% | 10.65% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.305 | 1.911 | 0.069 | 0.1952 | 11.92% | 21.58% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.647 | 2.493 | 0.09311 | 0.2634 | 13.88% | 9.14% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.681 | 1.941 | 0.02893 | 0.08183 | 4.58% | 14.46% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.599 | 2.031 | 0.05696 | 0.1611 | 8.76% | 11.91% |
| 50423 | | 8 | 1.934 | 1.636 | 2.232 | 1.494 | 2.557 | 0.126 | 0.3564 | 18.43% | 7.37% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.391 | 1.972 | 0.06438 | 0.1821 | 10.57% | 17.52% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.651 | 2.58 | 0.1087 | 0.3076 | 16.40% | 10.16% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.354 | 2.228 | 0.1016 | 0.2875 | 16.08% | 14.39% |
| 50427 | | 8 | 1.956 | 1.726 | 2.186 | 1.595 | 2.285 | 0.09731 | 0.2752 | 14.07% | 6.32% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.699 | 2.092 | 0.05194 | 0.1469 | 7.84% | 10.25% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.77 | 1.981 | 0.03076 | 0.08699 | 4.63% | 9.97% |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.8500 | 0.7405 | 0.9595 | 0.6000 | 1.0000 | 0.0463 | 0.1309 | 15.40% | 0.00% |
| 50415 | | 8 | 0.9125 | 0.8184 | 1.0000 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.34% | -7.35% |
| 50416 | | 8 | 0.8500 | 0.7726 | 0.9274 | 0.7000 | 1.0000 | 0.0327 | 0.0926 | 10.89% | 0.00% |
| 50417 | | 8 | 0.8875 | 0.8177 | 0.9573 | 0.8000 | 1.0000 | 0.0295 | 0.0835 | 9.40% | -4.41% |
| 50418 | | 8 | 0.8750 | 0.8159 | 0.9341 | 0.8000 | 1.0000 | 0.0250 | 0.0707 | 8.08% | -2.94% |
| 50419 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -8.82% |
| 50420 | | 8 | 0.9000 | 0.8001 | 0.9999 | 0.7000 | 1.0000 | 0.0423 | 0.1195 | 13.28% | -5.88% |
| 50421 | | 8 | 0.9375 | 0.8609 | 1.0000 | 0.8000 | 1.0000 | 0.0324 | 0.0916 | 9.77% | -10.29% |
| 50422 | | 8 | 0.9250 | 0.8509 | 0.9991 | 0.8000 | 1.0000 | 0.0313 | 0.0886 | 9.58% | -8.82% |
| 50423 | | 8 | 0.8750 | 0.7776 | 0.9724 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 13.31% | -2.94% |
| 50424 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.7000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | -2.94% |
| 50425 | | 8 | 0.8875 | 0.8046 | 0.9704 | 0.7000 | 1.0000 | 0.0350 | 0.0991 | 11.17% | -4.41% |
| 50426 | | 8 | 0.8250 | 0.7276 | 0.9224 | 0.7000 | 1.0000 | 0.0412 | 0.1165 | 14.12% | 2.94% |
| 50427 | | 8 | 0.8500 | 0.7236 | 0.9764 | 0.6000 | 1.0000 | 0.0535 | 0.1512 | 17.79% | 0.00% |
| 50428 | | 8 | 0.8750 | 0.7885 | 0.9615 | 0.8000 | 1.0000 | 0.0366 | 0.1035 | 11.83% | -2.94% |
| 50429 | | 8 | 0.8875 | 0.7934 | 0.9816 | 0.7000 | 1.0000 | 0.0398 | 0.1126 | 12.69% | -4.41% |

# CETIS Analytical Report

| | | | |
|---|---|---|---|
| **Report Date:** | 08 Sep-17 15:41 (p 1 of 1) | | |
| **Test Code:** | 80706 (F) \| 20-9205-6997 | | |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 02-7278-8673 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:35 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50415 | 05-7381-9684 | 07 Jun-17 10:00 | 15 Jun-17 16:35 | 55d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50415 | Sediment | PEPCO Benning Rd-Waterside In | SED6C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50415 failed mean af weight-mg | 9.96% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50415* | 2.963 | 1.761 | 0.208 | 14 | CDF | 0.0051 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.488935 | 0.488935 | 1 | 8.777 | 0.0103 | Significant Effect |
| Error | 0.779902 | 0.0557073 | 14 | | | |
| Total | 1.26884 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.876 | 8.885 | 0.4255 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.923 | 0.8408 | 0.1883 | Normal Distribution |

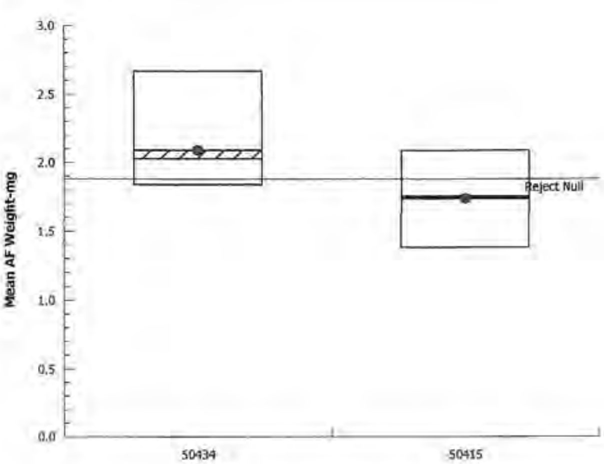
**Mean AF Weight-mg Summary**

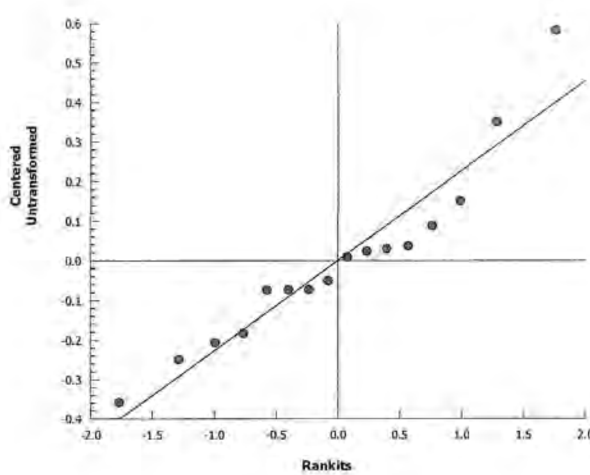
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50415 | | 8 | 1.738 | 1.574 | 1.903 | 1.754 | 1.38 | 2.088 | 0.06959 | 11.32% | 16.75% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50415 | | 1.761 | 1.775 | 1.747 | 1.826 | 2.088 | 1.665 | 1.38 | 1.664 |

**Graphics**



**Chironomus 10-d Survival and Growth Sediment Test** | **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-3008-2505 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50416 | 17-8931-1896 | 07 Jun-17 11:30 | 15 Jun-17 16:35 | 55d 8h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50416 | Sediment | PEPCO Benning Rd-Waterside In | SED8C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50416 failed mean af weight-mg | 9.23% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50416* | 3.265 | 1.761 | 0.193 | 14 | CDF | 0.0028 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.510556 | 0.510556 | 1 | 10.66 | 0.0056 | Significant Effect |
| Error | 0.670616 | 0.0479011 | 14 | | | |
| Total | 1.18117 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.143 | 8.885 | 0.1539 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8738 | 0.8408 | 0.0311 | Normal Distribution |

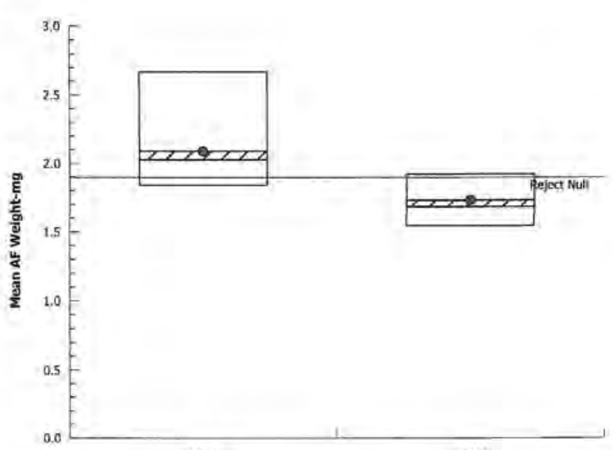
**Mean AF Weight-mg Summary**

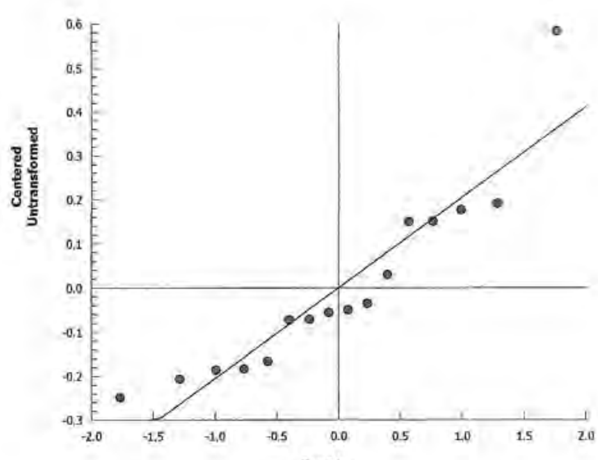
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50416 | | 8 | 1.731 | 1.603 | 1.858 | 1.684 | 1.544 | 1.921 | 0.05377 | 8.79% | 17.11% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50416 | | 1.921 | 1.674 | 1.659 | 1.544 | 1.564 | 1.694 | 1.907 | 1.88 |

**Graphics**



## CETIS Analytical Report

Report Date: 08 Sep-17 15:40 (p 1 of 1)
Test Code: 80706 (F) | 20-9205-6997

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 14-1628-3586 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 55d 7h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean af weight-mg | 9.52% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 6.014 | 1.761 | 0.199 | 14 | CDF | 1.6E-05 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 1.84401 | 1.84401 | 1 | 36.16 | 3.2E-05 | Significant Effect |
| Error | 0.713876 | 0.0509911 | 14 | | | |
| Total | 2.55788 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.48 | 8.885 | 0.2538 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8983 | 0.8408 | 0.0756 | Normal Distribution |

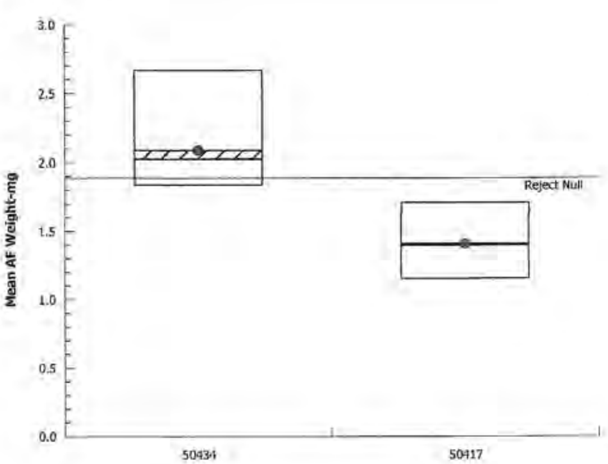
**Mean AF Weight-mg Summary**

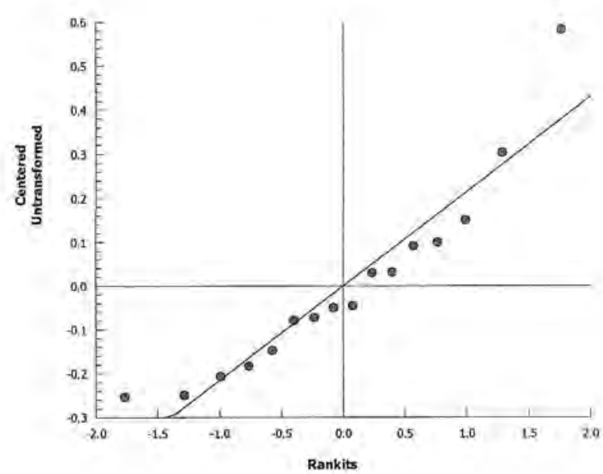
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50417 | | 8 | 1.409 | 1.266 | 1.552 | 1.402 | 1.156 | 1.712 | 0.06052 | 12.15% | 32.52% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50417 | | 1.509 | 1.5 | 1.261 | 1.712 | 1.33 | 1.156 | 1.363 | 1.44 |

**Graphics**



# CETIS Analytical Report

| | |
|---|---|
| Report Date: | 08 Sep-17 15:40 (p 1 of 1) |
| Test Code: | 80706 (F) \| 20-9205-6997 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 07-3978-4874 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50418 | 08-2555-0475 | 08 Jun-17 08:30 | 15 Jun-17 16:35 | 54d 11h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50418 | Sediment | PEPCO Benning Rd-Waterside In | SED7F00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50418 failed mean af weight-mg | 9.65% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50418* | 1.944 | 1.761 | 0.202 | 14 | CDF | 0.0361 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.197944 | 0.197944 | 1 | 3.781 | 0.0722 | Non-Significant Effect |
| Error | 0.732966 | 0.0523547 | 14 | | | |
| Total | 0.93091 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.269 | 8.885 | 0.3019 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8929 | 0.8408 | 0.0619 | Normal Distribution |

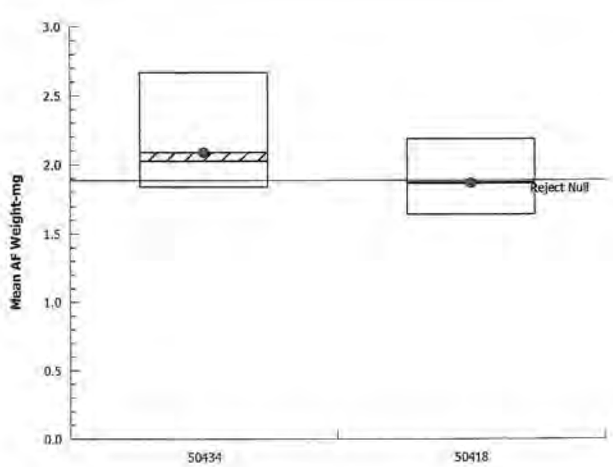
**Mean AF Weight-mg Summary**

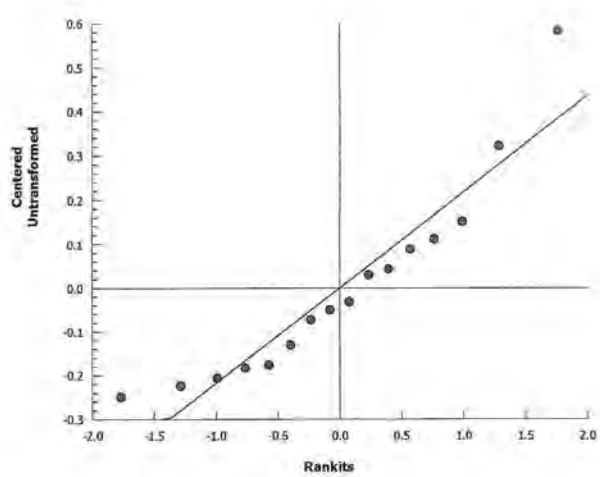
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50418 | | 8 | 1.865 | 1.716 | 2.015 | 1.871 | 1.641 | 2.186 | 0.06328 | 9.59% | 10.65% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50418 | | 1.977 | 1.909 | 1.833 | 1.735 | 1.641 | 1.689 | 1.953 | 2.186 |

**Graphics**



## CETIS Analytical Report

| | |
|---|---|
| **Report Date:** | 08 Sep-17 15:40 (p 1 of 1) |
| **Test Code:** | 80706 (F) \| 20-9205-6997 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-0609-0932 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 54d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean af weight-mg | 9.93% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50419* | 3.83 | 1.761 | 0.207 | 14 | CDF | 9.2E-04 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.812353 | 0.812353 | 1 | 14.67 | 0.0018 | Significant Effect |
| Error | 0.775356 | 0.0553826 | 14 | | | |
| Total | 1.58771 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.908 | 8.885 | 0.4133 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9445 | 0.8408 | 0.4080 | Normal Distribution |

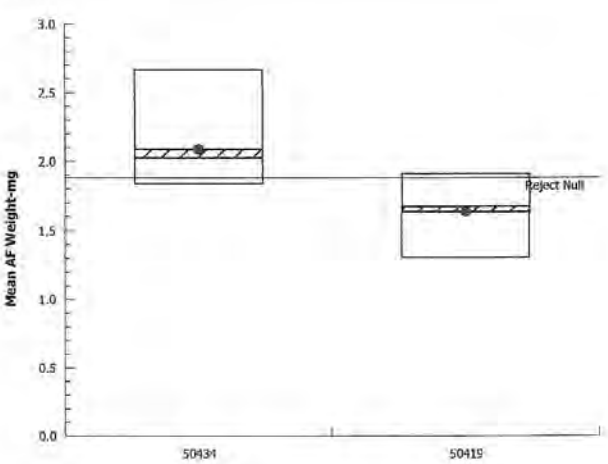
**Mean AF Weight-mg Summary**

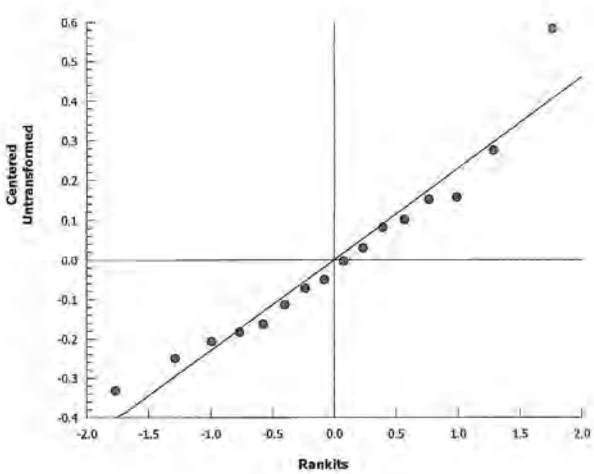
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50419 | | 8 | 1.637 | 1.474 | 1.8 | 1.676 | 1.305 | 1.911 | 0.069 | 11.92% | 21.58% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50419 | | 1.474 | 1.634 | 1.793 | 1.911 | 1.305 | 1.719 | 1.522 | 1.738 |

**Graphics**



## CETIS Analytical Report

**Report Date:** 08 Sep-17 15:40 (p 1 of 1)
**Test Code:** 80706 (F) | 20-9205-6997

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 12-0386-9864 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Nonparametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50420 | 11-9421-7426 | 08 Jun-17 10:00 | 15 Jun-17 16:35 | 54d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50420 | Sediment | PEPCO Benning Rd-Waterside In | SED6.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50420 failed mean af weight-mg | 11.24% |

### Wilcoxon Rank Sum Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | Ties | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50420* | 51 | n/a | 0 | 14 | Exact | 0.0415 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.145721 | 0.145721 | 1 | 2.052 | 0.1740 | Non-Significant Effect |
| Error | 0.994228 | 0.0710163 | 14 | | | |
| Total | 1.13995 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.048 | 8.885 | 0.9524 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.7959 | 0.8408 | 0.0024 | Non-Normal Distribution |

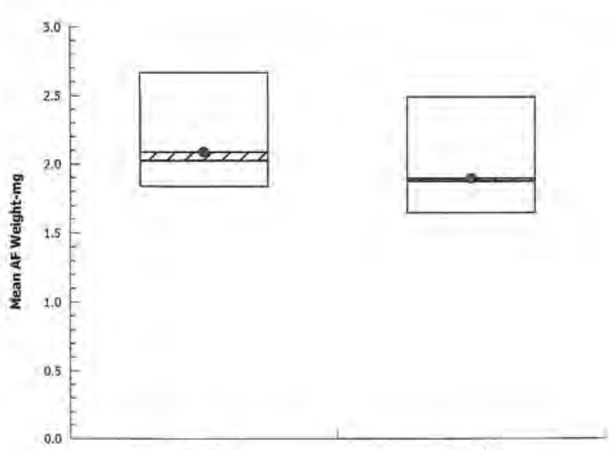
### Mean AF Weight-mg Summary

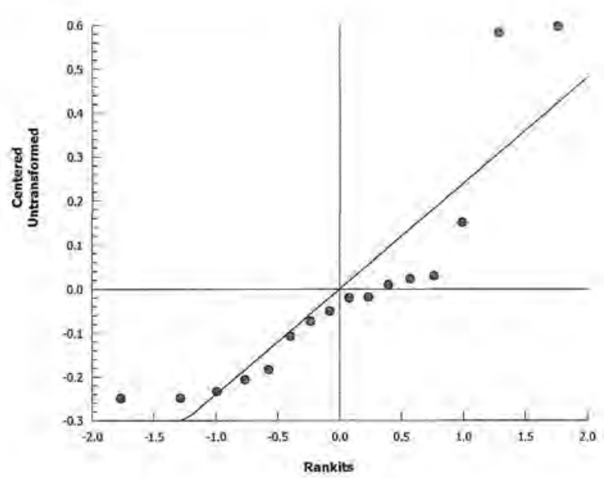
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50420 | | 8 | 1.897 | 1.677 | 2.117 | 1.878 | 1.647 | 2.493 | 0.09311 | 13.88% | 9.14% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50420 | | 1.79 | 1.907 | 1.879 | 2.493 | 1.663 | 1.647 | 1.92 | 1.877 |

### Graphics



## CETIS Analytical Report

| | |
|---|---|
| **Report Date:** | 08 Sep-17 15:40 (p 1 of 1) |
| **Test Code:** | 80706 (F) \| 20-9205-6997 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 13-1592-4748 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Nonparametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50421 | 10-8432-1021 | 08 Jun-17 10:30 | 15 Jun-17 16:35 | 54d 9h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50421 | Sediment | PEPCO Benning Rd-Waterside In | SED7E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50421 failed mean af weight-mg | 8.40% |

### Wilcoxon Rank Sum Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | Ties | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50421* | 39 | n/a | 0 | 14 | Exact | 5.4E-04 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.364445 | 0.364445 | 1 | 9.183 | 0.0090 | Significant Effect |
| Error | 0.555604 | 0.039686 | 14 | | | |
| Total | 0.920049 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 10.85 | 8.885 | 0.0055 | Unequal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8377 | 0.8408 | 0.0090 | Non-Normal Distribution |

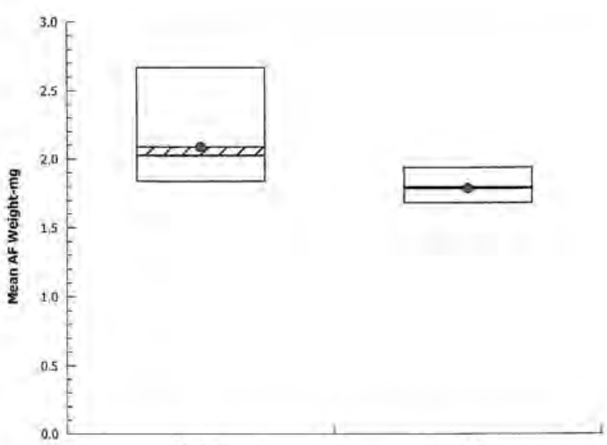
### Mean AF Weight-mg Summary

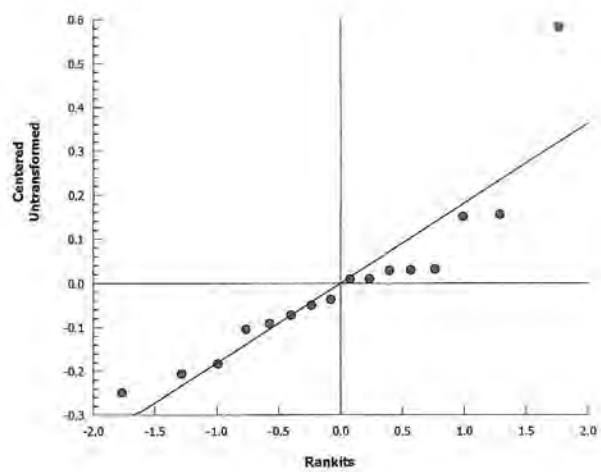
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50421 | | 8 | 1.786 | 1.718 | 1.854 | 1.795 | 1.681 | 1.941 | 0.02893 | 4.58% | 14.46% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50421 | | 1.941 | 1.681 | 1.814 | 1.749 | 1.694 | 1.796 | 1.818 | 1.795 |

### Graphics



# CETIS Analytical Report

**Report Date:** 08 Sep-17 15:39 (p 1 of 1)
**Test Code:** 80706 (F) | 20-9205-6997

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 00-7069-2635 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50422 | 08-1584-0119 | 08 Jun-17 12:30 | 15 Jun-17 16:35 | 54d 7h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50422 | Sediment | PEPCO Benning Rd-Waterside In | SED6B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50422 failed mean af weight-mg | 9.37% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50422* | 2.239 | 1.761 | 0.196 | 14 | CDF | 0.0210 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.24723 | 0.24723 | 1 | 5.013 | 0.0419 | Significant Effect |
| Error | 0.690448 | 0.0493177 | 14 | | | |
| Total | 0.937677 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.8 | 8.885 | 0.1978 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.888 | 0.8408 | 0.0517 | Normal Distribution |

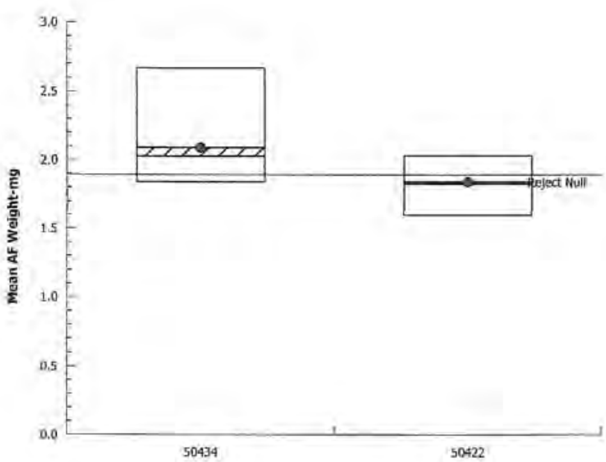
### Mean AF Weight-mg Summary

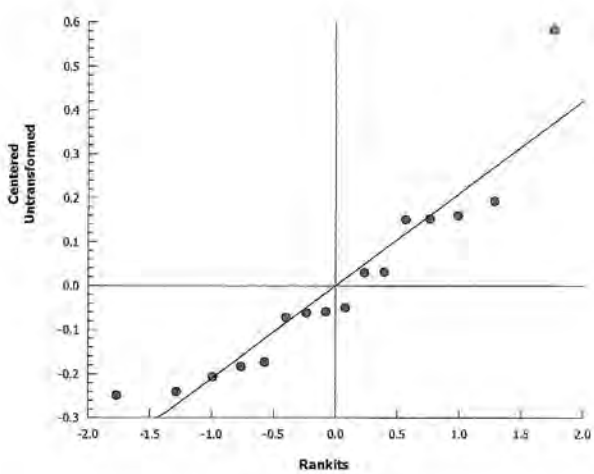
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50422 | | 8 | 1.839 | 1.705 | 1.974 | 1.825 | 1.599 | 2.031 | 0.05696 | 8.76% | 11.91% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50422 | | 1.78 | 1.777 | 2.031 | 1.599 | 1.87 | 1.999 | 1.666 | 1.992 |

### Graphics



# CETIS Analytical Report

| | |
|---|---|
| **Report Date:** | 08 Sep-17 15:39 (p 1 of 1) |
| **Test Code:** | 80706 (F) \| 20-9205-6997 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 05-5676-0764 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50424 | 00-7068-4401 | 09 Jun-17 08:15 | 15 Jun-17 16:35 | 53d 11h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50424 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50424 failed mean af weight-mg | 9.70% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50424* | 3.181 | 1.761 | 0.203 | 14 | CDF | 0.0033 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.535395 | 0.535395 | 1 | 10.12 | 0.0067 | Significant Effect |
| Error | 0.740806 | 0.0529147 | 14 | | | |
| Total | 1.2762 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.192 | 8.885 | 0.3222 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9389 | 0.8408 | 0.3358 | Normal Distribution |

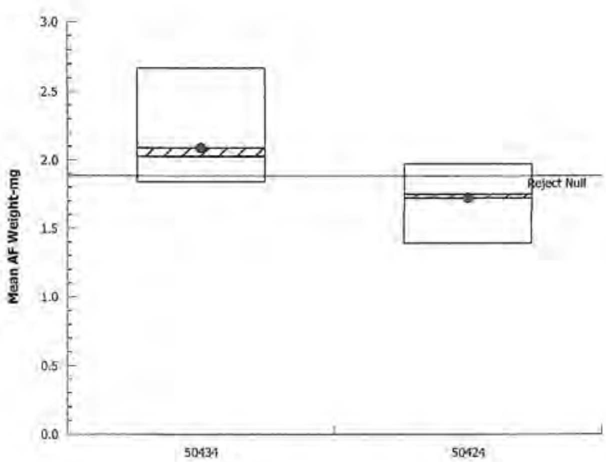
**Mean AF Weight-mg Summary**

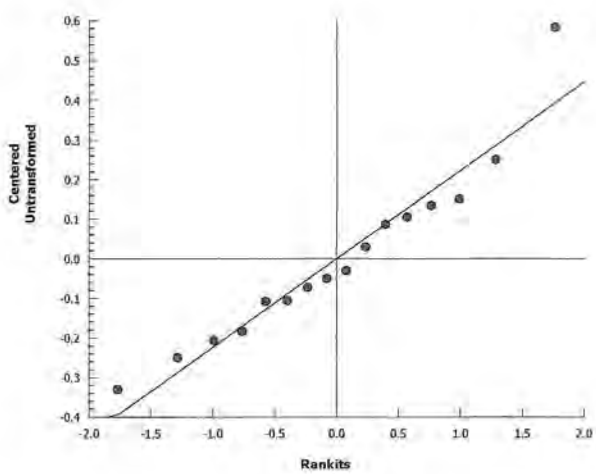
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50424 | | 8 | 1.722 | 1.57 | 1.874 | 1.75 | 1.391 | 1.972 | 0.06438 | 10.57% | 17.52% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50424 | | 1.691 | 1.809 | 1.391 | 1.614 | 1.972 | 1.827 | 1.856 | 1.616 |

**Graphics**



## CETIS Analytical Report

| | |
|---|---|
| **Report Date:** | 08 Sep-17 15:39 (p 1 of 1) |
| **Test Code:** | 80706 (F) \| 20-9205-6997 |

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 19-1201-0269 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Nonparametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50425 | 20-3042-7428 | 09 Jun-17 09:15 | 15 Jun-17 16:35 | 53d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50425 | Sediment | PEPCO Benning Rd-Waterside In | SED7D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50425 failed mean af weight-mg | 12.20% |

### Wilcoxon Rank Sum Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | Ties | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50425* | 47 | n/a | 0 | 14 | Exact | 0.0141 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.179812 | 0.179812 | 1 | 2.15 | 0.1647 | Non-Significant Effect |
| Error | 1.17099 | 0.0836418 | 14 | | | |
| Total | 1.3508 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.302 | 8.885 | 0.7367 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.7741 | 0.8408 | 0.0013 | Non-Normal Distribution |

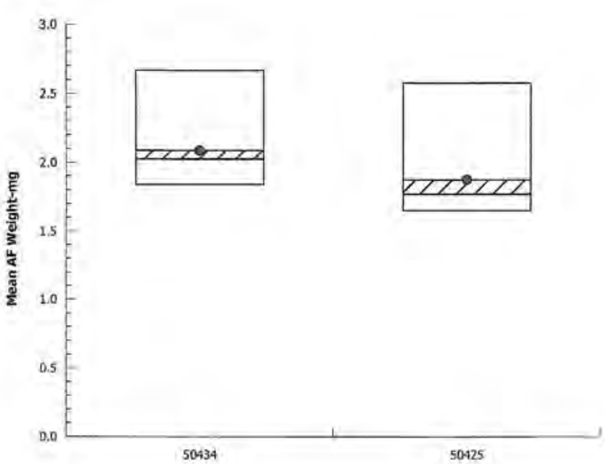
### Mean AF Weight-mg Summary

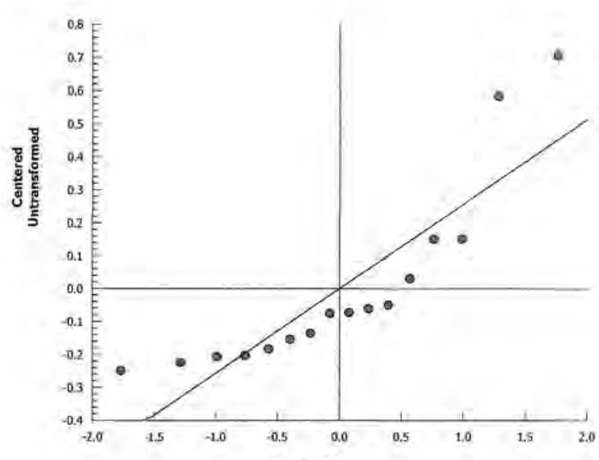
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50425 | | 8 | 1.876 | 1.619 | 2.133 | 1.77 | 1.651 | 2.58 | 0.1087 | 16.40% | 10.16% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50425 | | 1.8 | 1.814 | 1.673 | 2.027 | 1.721 | 1.74 | 2.58 | 1.651 |

### Graphics



# CETIS Analytical Report

Report Date: 08 Sep-17 15:38 (p 1 of 1)
Test Code: 80706 (F) | 20-9205-6997

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-9215-9226 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50426 | 17-5556-0091 | 09 Jun-17 09:45 | 15 Jun-17 16:35 | 53d 10h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50426 | Sediment | PEPCO Benning Rd-Waterside In | SED6.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50426 failed mean af weight-mg | 11.75% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50426* | 2.157 | 1.761 | 0.245 | 14 | CDF | 0.0245 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.361141 | 0.361141 | 1 | 4.651 | 0.0489 | Significant Effect |
| Error | 1.08716 | 0.0776543 | 14 | | | |
| Total | 1.4483 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.137 | 8.885 | 0.8698 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.948 | 0.8408 | 0.4591 | Normal Distribution |

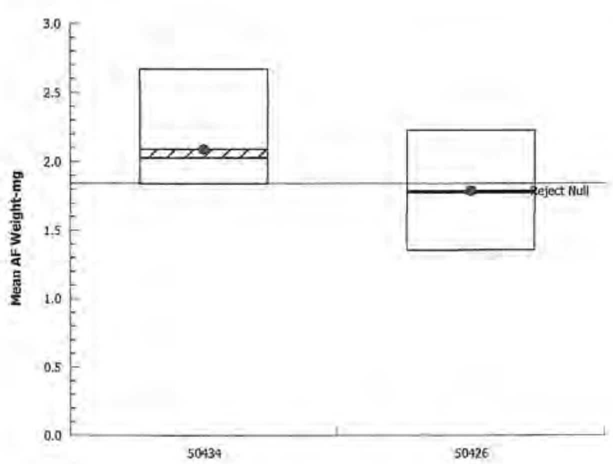
**Mean AF Weight-mg Summary**

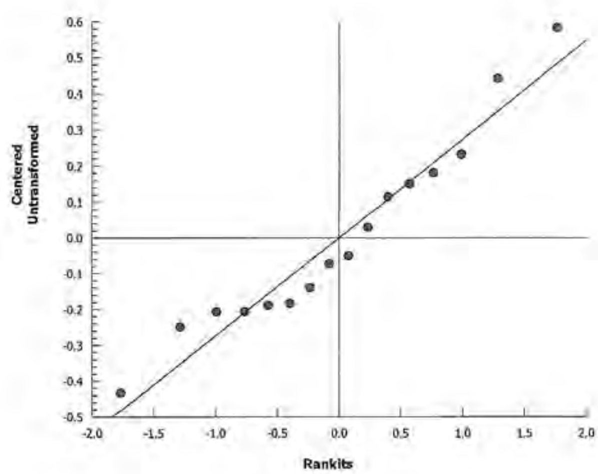
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50426 | | 8 | 1.787 | 1.547 | 2.028 | 1.775 | 1.354 | 2.228 | 0.1016 | 16.08% | 14.39% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50426 | | 1.599 | 2.019 | 1.647 | 1.902 | 2.228 | 1.968 | 1.354 | 1.581 |

**Graphics**



**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 10-8407-0040 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50428 | 13-4023-9623 | 09 Jun-17 11:15 | 15 Jun-17 16:35 | 53d 8h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50428 | Sediment | PEPCO Benning Rd-Waterside In | SED7A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50428 failed mean af weight-mg | 9.16% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50428* | 1.972 | 1.761 | 0.191 | 14 | CDF | 0.0343 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.183294 | 0.183294 | 1 | 3.889 | 0.0687 | Non-Significant Effect |
| Error | 0.659798 | 0.0471284 | 14 | | | |
| Total | 0.843092 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.368 | 8.885 | 0.1316 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8848 | 0.8408 | 0.0462 | Normal Distribution |

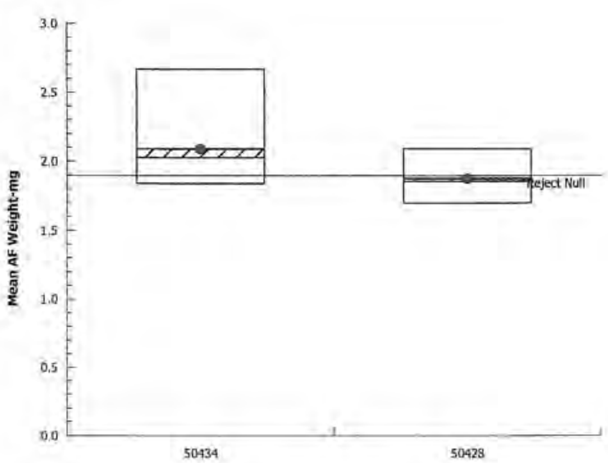
### Mean AF Weight-mg Summary

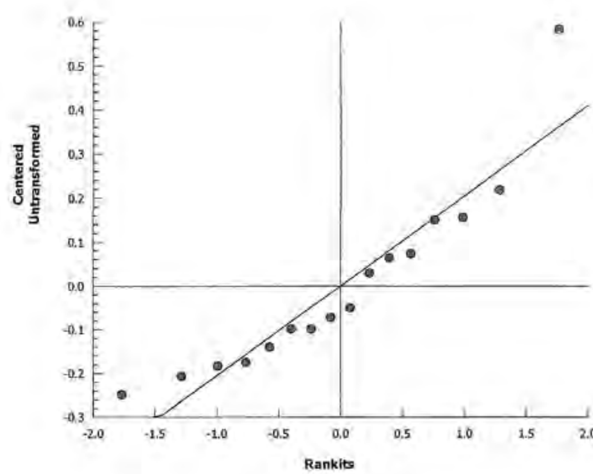
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50428 | | 8 | 1.874 | 1.751 | 1.997 | 1.857 | 1.699 | 2.092 | 0.05194 | 7.84% | 10.25% |

### Mean AF Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50428 | | 1.775 | 2.092 | 1.699 | 1.775 | 1.938 | 1.947 | 2.03 | 1.734 |

### Graphics



# CETIS Analytical Report

Report Date: 08 Sep-17 15:38 (p 1 of 1)
Test Code: 80706 (F) | 20-9205-6997

**Chironomus 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 03-8967-0517 | **Endpoint:** | Mean AF Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 08 Sep-17 15:36 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 49d 10h | AECOM (MA) | Sediment Testing |
| 50429 | 15-9301-4614 | 09 Jun-17 12:00 | 15 Jun-17 16:35 | 53d 8h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50429 | Sediment | PEPCO Benning Rd-Waterside In | SED8B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50429 failed mean af weight-mg | 8.92% |

**Unequal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50429* | 2.078 | 1.86 | 0.186 | 8 | CDF | 0.0357 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.173173 | 0.173173 | 1 | 4.316 | 0.0566 | Non-Significant Effect |
| Error | 0.561706 | 0.0401219 | 14 | | | |
| Total | 0.734879 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 9.604 | 8.885 | 0.0079 | Unequal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8452 | 0.8408 | 0.0116 | Normal Distribution |

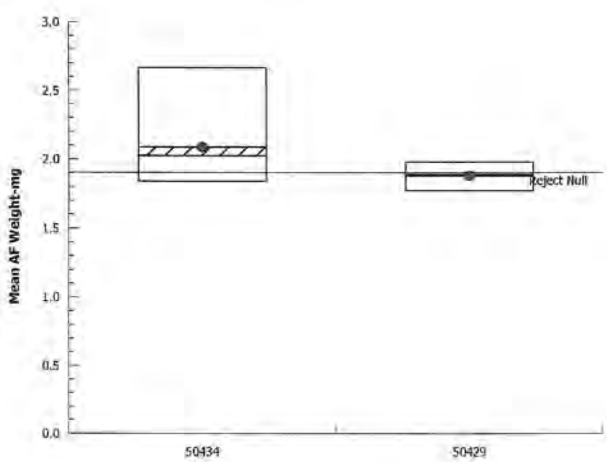
**Mean AF Weight-mg Summary**

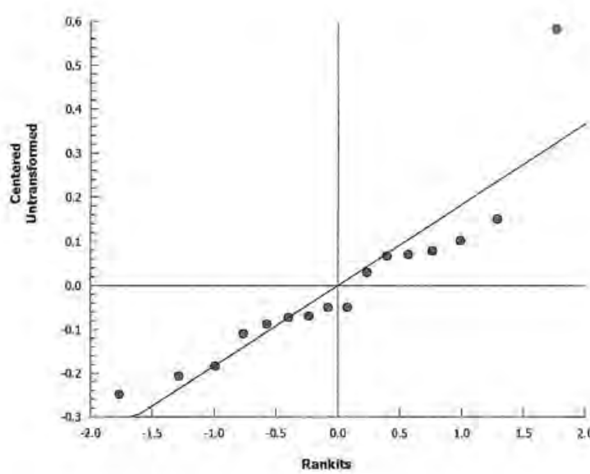
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 2.088 | 1.862 | 2.313 | 2.026 | 1.839 | 2.67 | 0.09531 | 12.91% | 0.00% |
| 50429 | | 8 | 1.88 | 1.807 | 1.952 | 1.888 | 1.77 | 1.981 | 0.03076 | 4.63% | 9.97% |

**Mean AF Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 2.037 | 1.881 | 2.015 | 2.67 | 2.117 | 1.839 | 1.904 | 2.238 |
| 50429 | | 1.946 | 1.981 | 1.958 | 1.792 | 1.77 | 1.81 | 1.83 | 1.95 |

**Graphics**



**Chironomus 10-d Survival and Growth Sediment Test** **Aquatec Environmental, Inc.**

**Start Date:** 01 Aug-17 19:30 **Species:** Chironomus dilutus **Sample Code:** 50434
**End Date:** 11 Aug-17 16:45 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** PEPCO Benning Rd-Waterside Inve
**Sample Date:** 13 Jun-17 09:45 **Material:** Reference sediment **Sample Station:** SEDBACK2000N

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | 1 | 40 | 10 | 9 | 2226.64 | 2210.34 | 8 | | | |
| 50434 | 2 | 124 | 10 | 9 | 2255.22 | 2240.17 | 8 | | | |
| 50434 | 3 | 107 | 10 | 9 | 2419.68 | 2407.59 | 6 | | | |
| 50434 | 4 | 61 | 10 | 7 | 2407.67 | 2399.66 | 3 | | | |
| 50434 | 5 | 103 | 10 | 9 | 2517.56 | 2500.62 | 8 | | | |
| 50434 | 6 | 26 | 10 | 9 | 2299.13 | 2286.26 | 7 | | | |
| 50434 | 7 | 66 | 10 | 10 | 2447.8 | 2430.66 | 9 | | | |
| 50434 | 8 | 15 | 10 | 6 | 2234.17 | 2220.74 | 6 | | | |
| 50415 | 1 | 37 | 10 | 9 | 2299.25 | 2286.92 | 7 | | | |
| 50415 | 2 | 7 | 10 | 9 | 2339.95 | 2325.75 | 8 | | | |
| 50415 | 3 | 86 | 10 | 10 | 2295.3 | 2284.82 | 6 | | | |
| 50415 | 4 | 36 | 10 | 8 | 2405.82 | 2393.04 | 7 | | | |
| 50415 | 5 | 69 | 10 | 7 | 2498.95 | 2488.51 | 5 | | | |
| 50415 | 6 | 39 | 10 | 10 | 2278.14 | 2268.15 | 6 | | | |
| 50415 | 7 | 32 | 10 | 10 | 2397.55 | 2387.89 | 7 | | | |
| 50415 | 8 | 126 | 10 | 10 | 2444.03 | 2430.72 | 8 | | | |
| 50416 | 1 | 49 | 10 | 8 | 2462.55 | 2449.1 | 7 | | | |
| 50416 | 2 | 70 | 10 | 10 | 2324.27 | 2307.53 | 10 | | | |
| 50416 | 3 | 108 | 10 | 9 | 2399.91 | 2384.98 | 9 | | | |
| 50416 | 4 | 127 | 10 | 9 | 2398.18 | 2384.28 | 9 | | | |
| 50416 | 5 | 88 | 10 | 8 | 2231.44 | 2220.49 | 7 | | | |
| 50416 | 6 | 47 | 10 | 9 | 2437.69 | 2425.83 | 7 | | | |
| 50416 | 7 | 84 | 10 | 7 | 2322.69 | 2309.34 | 7 | | | |
| 50416 | 8 | 54 | 10 | 8 | 2316.59 | 2305.31 | 6 | | | |
| 50417 | 1 | 71 | 10 | 8 | 2178.96 | 2166.89 | 8 | | | |
| 50417 | 2 | 24 | 10 | 9 | 2164.7 | 2152.7 | 8 | | | |
| 50417 | 3 | 123 | 10 | 9 | 2115.26 | 2106.43 | 7 | | | |
| 50417 | 4 | 13 | 10 | 8 | 2199.69 | 2189.42 | 6 | | | |
| 50417 | 5 | 59 | 10 | 10 | 2266.87 | 2253.57 | 10 | | | |
| 50417 | 6 | 5 | 10 | 10 | 2153.9 | 2143.5 | 9 | | | |
| 50417 | 7 | 10 | 10 | 9 | 2047.12 | 2034.85 | 9 | | | |
| 50417 | 8 | 53 | 10 | 8 | 2179.02 | 2168.94 | 7 | | | |
| 50418 | 1 | 83 | 10 | 8 | 2172.05 | 2160.19 | 6 | | | |
| 50418 | 2 | 51 | 10 | 8 | 2198.71 | 2185.35 | 7 | | | |
| 50418 | 3 | 1 | 10 | 9 | 2078.14 | 2061.64 | 9 | | | |
| 50418 | 4 | 75 | 10 | 9 | 2208 | 2197.59 | 6 | | | |
| 50418 | 5 | 55 | 10 | 9 | 2128.59 | 2115.46 | 8 | | | |
| 50418 | 6 | 38 | 10 | 10 | 2211.14 | 2197.63 | 8 | | | |
| 50418 | 7 | 42 | 10 | 9 | 2226.28 | 2208.7 | 9 | | | |
| 50418 | 8 | 102 | 10 | 8 | 2232.01 | 2221.08 | 5 | | | |
| 50419 | 1 | 79 | 10 | 10 | 2137.6 | 2122.86 | 10 | | | |
| 50419 | 2 | 65 | 10 | 10 | 2075.08 | 2058.74 | 10 | | | |
| 50419 | 3 | 80 | 10 | 9 | 2203.29 | 2187.15 | 9 | | | |
| 50419 | 4 | 119 | 10 | 8 | 2156.5 | 2143.12 | 7 | | | |
| 50419 | 5 | 113 | 10 | 10 | 2220.4 | 2207.35 | 10 | | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 19 | 10 | 9 | 2207.66 | 2193.91 | 8 | | | |
| 50419 | 7 | 89 | 10 | 10 | 2197.41 | 2185.23 | 8 | | | |
| 50419 | 8 | 98 | 10 | 8 | 2235.22 | 2224.79 | 6 | | | |
| 50420 | 1 | 16 | 10 | 10 | 2198.79 | 2180.89 | 10 | | | |
| 50420 | 2 | 6 | 10 | 8 | 2222.76 | 2211.32 | 6 | | | |
| 50420 | 3 | 11 | 10 | 9 | 2180.75 | 2167.6 | 7 | | | |
| 50420 | 4 | 101 | 10 | 7 | 2474.78 | 2459.82 | 6 | | | |
| 50420 | 5 | 99 | 10 | 10 | 2157.79 | 2146.15 | 7 | | | |
| 50420 | 6 | 25 | 10 | 10 | 2124.4 | 2111.22 | 8 | | | |
| 50420 | 7 | 125 | 10 | 8 | 2127.79 | 2114.35 | 7 | | | |
| 50420 | 8 | 122 | 10 | 10 | 2134.34 | 2117.45 | 9 | | | |
| 50421 | 1 | 41 | 10 | 10 | 2039.98 | 2024.45 | 8 | | | |
| 50421 | 2 | 9 | 10 | 10 | 2243.29 | 2228.16 | 9 | | | |
| 50421 | 3 | 77 | 10 | 8 | 2191.22 | 2178.52 | 7 | | | |
| 50421 | 4 | 43 | 10 | 10 | 2128.78 | 2114.79 | 8 | | | |
| 50421 | 5 | 45 | 10 | 9 | 2140.17 | 2128.31 | 7 | | | |
| 50421 | 6 | 74 | 10 | 10 | 2120.11 | 2103.95 | 9 | | | |
| 50421 | 7 | 28 | 10 | 10 | 2199.8 | 2185.26 | 8 | | | |
| 50421 | 8 | 82 | 10 | 8 | 2219.81 | 2205.45 | 8 | | | |
| 50422 | 1 | 58 | 10 | 10 | 2161.55 | 2145.53 | 9 | | | |
| 50422 | 2 | 4 | 10 | 8 | 2297.93 | 2285.49 | 7 | | | |
| 50422 | 3 | 87 | 10 | 8 | 2083.43 | 2069.21 | 7 | | | |
| 50422 | 4 | 104 | 10 | 10 | 2035.97 | 2024.78 | 7 | | | |
| 50422 | 5 | 117 | 10 | 9 | 2208.11 | 2196.89 | 6 | | | |
| 50422 | 6 | 8 | 10 | 10 | 2214.72 | 2200.73 | 7 | | | |
| 50422 | 7 | 60 | 10 | 10 | 2162.86 | 2149.53 | 8 | | | |
| 50422 | 8 | 23 | 10 | 9 | 2321.46 | 2309.51 | 6 | | | |
| 50423 | 1 | 112 | 10 | 7 | 2544.52 | 2535.91 | 4 | | | |
| 50423 | 2 | 31 | 10 | 7 | 2219.01 | 2205.81 | 6 | | | |
| 50423 | 3 | 12 | 10 | 9 | 2204.08 | 2190.81 | 8 | | | |
| 50423 | 4 | 111 | 10 | 9 | 2259.73 | 2246.28 | 9 | | | |
| 50423 | 5 | 97 | 10 | 10 | 2066.62 | 2050.05 | 10 | | | |
| 50423 | 6 | 73 | 10 | 9 | 2143.49 | 2125.5 | 9 | | | |
| 50423 | 7 | 90 | 10 | 10 | 2207.57 | 2195.3 | 7 | | | |
| 50423 | 8 | 94 | 10 | 9 | 2129.45 | 2121.78 | 3 | | | |
| 50424 | 1 | 106 | 10 | 9 | 2190.71 | 2178.87 | 7 | | | |
| 50424 | 2 | 93 | 10 | 8 | 2174.42 | 2161.76 | 7 | | | |
| 50424 | 3 | 100 | 10 | 10 | 2108.99 | 2096.47 | 9 | | | |
| 50424 | 4 | 121 | 10 | 9 | 2449.83 | 2438.53 | 7 | | | |
| 50424 | 5 | 18 | 10 | 7 | 2267.91 | 2258.05 | 5 | | | |
| 50424 | 6 | 105 | 10 | 9 | 2081.98 | 2071.02 | 6 | | | |
| 50424 | 7 | 64 | 10 | 8 | 2261.58 | 2248.59 | 7 | | | |
| 50424 | 8 | 63 | 10 | 10 | 2228.99 | 2212.83 | 10 | | | |
| 50425 | 1 | 33 | 10 | 9 | 2119.13 | 2106.53 | 7 | | | |
| 50425 | 2 | 76 | 10 | 10 | 2240.25 | 2227.55 | 7 | | | |
| 50425 | 3 | 27 | 10 | 9 | 2214.27 | 2202.56 | 7 | | | |
| 50425 | 4 | 68 | 10 | 8 | 2139.09 | 2126.93 | 6 | | | |
| 50425 | 5 | 114 | 10 | 9 | 2309.43 | 2295.66 | 8 | | | |
| 50425 | 6 | 109 | 10 | 9 | 2227.23 | 2215.05 | 7 | | | |
| 50425 | 7 | 67 | 10 | 7 | 2164.29 | 2159.13 | 2 | | | |

## CETIS Test Data Worksheet



| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Ashed Weight-mg | Pan Count | Mean Length-mm | Survival | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 22 | 10 | 10 | 2163.2 | 2149.99 | 8 | | | |
| 50426 | 1 | 48 | 10 | 9 | 2226.31 | 2213.52 | 8 | | | |
| 50426 | 2 | 96 | 10 | 7 | 2354.81 | 2340.68 | 7 | | | |
| 50426 | 3 | 81 | 10 | 9 | 2231.22 | 2218.04 | 8 | | | |
| 50426 | 4 | 78 | 10 | 8 | 2444.87 | 2433.46 | 6 | | | |
| 50426 | 5 | 72 | 10 | 7 | 2390.31 | 2379.17 | 5 | | | |
| 50426 | 6 | 57 | 10 | 7 | 2362.15 | 2350.34 | 6 | | | |
| 50426 | 7 | 115 | 10 | 10 | 2343.96 | 2331.77 | 9 | | | |
| 50426 | 8 | 110 | 10 | 9 | 2407.34 | 2396.27 | 7 | | | |
| 50427 | 1 | 14 | 10 | 8 | 2476.02 | 2467.02 | 4 | | | |
| 50427 | 2 | 91 | 10 | 6 | 2366.13 | 2356.99 | 4 | | | |
| 50427 | 3 | 44 | 10 | 8 | 2428.5 | 2413.79 | 7 | | | |
| 50427 | 4 | 20 | 10 | 9 | 2373.14 | 2360.36 | 6 | | | |
| 50427 | 5 | 46 | 10 | 10 | 2343.17 | 2325.07 | 10 | | | |
| 50427 | 6 | 29 | 10 | 10 | 2273.99 | 2261.18 | 8 | | | |
| 50427 | 7 | 52 | 10 | 7 | 2364.6 | 2355.23 | 5 | | | |
| 50427 | 8 | 85 | 10 | 10 | 2223.49 | 2210.73 | 8 | | | |
| 50428 | 1 | 118 | 10 | 10 | 2391.69 | 2377.49 | 8 | | | |
| 50428 | 2 | 17 | 10 | 8 | 2155.16 | 2142.61 | 6 | | | |
| 50428 | 3 | 95 | 10 | 10 | 2183.72 | 2168.43 | 9 | | | |
| 50428 | 4 | 120 | 10 | 8 | 2274.73 | 2264.08 | 6 | | | |
| 50428 | 5 | 21 | 10 | 8 | 2493.86 | 2484.17 | 5 | | | |
| 50428 | 6 | 35 | 10 | 8 | 2350.13 | 2334.55 | 8 | | | |
| 50428 | 7 | 56 | 10 | 8 | 2337.99 | 2323.78 | 7 | | | |
| 50428 | 8 | 62 | 10 | 10 | 2189.29 | 2171.95 | 10 | | | |
| 50429 | 1 | 128 | 10 | 9 | 2281.62 | 2266.05 | 8 | | | |
| 50429 | 2 | 30 | 10 | 9 | 2443.35 | 2429.48 | 7 | | | |
| 50429 | 3 | 50 | 10 | 8 | 2242.71 | 2230.96 | 6 | | | |
| 50429 | 4 | 2 | 10 | 10 | 2247.5 | 2229.58 | 10 | | | |
| 50429 | 5 | 3 | 10 | 10 | 2390.01 | 2374.08 | 9 | | | |
| 50429 | 6 | 116 | 10 | 7 | 2362.13 | 2353.08 | 5 | | | |
| 50429 | 7 | 34 | 10 | 8 | 2413.47 | 2404.32 | 5 | | | |
| 50429 | 8 | 92 | 10 | 10 | 2306.54 | 2290.94 | 8 | | | |

# 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Surviving # L | P | E | INIT | Total Surviving | Crucible Number | Number weighed | Initial Crucible | Final Crucible | Ashed Crucible |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **50413** | A | 8 | 0 | 1 | JW | 9 | 1 | 8 | 2239.59 | 2261.79 | 2247.~~19~~24 JW |
| | B | 6 | 1 | 2 | EB | 9 | 2 | 6 | 2120.82 | 2134.15 | 2123.55 |
| CONTROL | C | 7 | 1 | 1 | JW | 9 | 3 | 7 | 2386.59 | 2406.66 | 2393.44 |
| | D | 9 | 0 | 0 | JW | 9 | 4 | 9 | 2287.33 | 2309.32 | 2294.38 JW 8/14/17 |
| ① | E | ~~75~~ | ~~1~~ | 2 | EB | 9 | 5 | 7 | 2313.89 | 2331.58 | 2319.24 |
| | F | JW 9 | 1 | 0 | JW | 10 | 6 | 9 | 2130.40 | 2153.35 | 2137.94 |
| | G | 4 | 3 | 2 | JW | 9 | 7 | 4 | 2181.44 | 2193.04 | 2185.09 |
| | H | 4 | 2 | 3 | KP | 9 | 8 | 4 | 2491.51 | 2503.68 | 2493.66 |
| **50415** | A | 7 | 1 | 1 | KP | 9 | 9 | 7 | 2283.37 | 2299.25 | 2286.93 |
| | B | 8 | 0 | 1 | KP | 9 | 10 | 8 | 2321.45 | 2339.95 | 2325.75 |
| SED6C00EN | C | 7 | 2 | 1 | JW | 10 | 11 | 6 | 2282.69 | 2295.30 | 2284.82 |
| | D | 7 | 0 | 1 | KP | 8 | 12 | 7 | 2389.87 | 2405.82 | 2393.04 |
| | E | 5 | KW ~~2~~1 | 1 | JW | 7 | 13 | 5 | 2485.21 | 2498.95 | 2488.51 |
| | F | KW ~~7~~6 | ~~4~~3 | ~~1~~0 | EB | 10 | 14 | 6 | 2263.68 | 2278.14 | 2268.15 |
| | G | 7 | 3 | 0 | EB | 10 | 15 | 7 | 2385.69 | 2397.55 | 2387.89 |
| | H | 8 ~~9~~ | 1 | 1 | JW | ~~#~~ 10 | 16 | 8 | 2426.55 | 2444.03 | 2430.72 |
| **50416** | A | 7 | 0 | 1 | EB | 8 | 17 | 7 | 2445.19 | 2462.55 | 2449.10 |
| | B | 10 | 0 | 0 | KP | 10 | 18 | 10 | 2302.44 | 2324.27 | 2307.53 |
| SED8C00EN | C | 9 | 0 | 0 | EB | 9 | 19 | 9 | 2377.87 | 2399.91 | 2384.98 |
| | D | 9 | 0 | 0 | KP | 9 | 20 | 9 | 2380.75 | 2398.18 | 2384.28 |
| | E | 7 | 0 | 1 | JW | 8 | 21 | 7 | 2218.17 | 2231.44 | 2220.49 |
| | F | 7 | 2 | 0 | KP | 9 | 22 | 7 | 2422.21 | 2437.69 | 2425.83 |
| | G | 7 | 0 | 0 | KP | 7 | 23 | 7 | 2306.94 | 2322.69 | 2309.34 |
| | H | 6 | 1 | 1 | JW | 8 | 24 | 6 | 2302.09 | 2316.59 | 2305.31 JW 8/14/17 |
| **50417** | A | 8 | 0 | 0 | JW | 8 | 25 | 8 | 2163.20 | 2178.96 | 2166.89 |
| | B | 8 | 1 | 0 | EB | 9 | 26 | 8 | 2148.70 | 2164.70 | 2152.70 EB 8/16/17 |
| SED7B00EN | C | 7 | 2 | 0 | EB | 9 | 27 | 7 | 2103.43 | 2115.26 | 2106.43 |
| | D | 6 | 0 | 2 | KP | 8 | 28 | 6 | 2187.25 | 2199.69 | 2189.42 |
| | E | 10 | 0 | 0 | JW | 10 | 29 | 10 | 2248.11 | 2266.87 | 2253.57 |
| | F | 10 | 0 | 0 | KP | 10 | 30 | 9 | 2139.13 | 2153.90 | 2143.50 |
| | G | 9 | 0 | 0 | JW | 9 | 31 | 9 | 2030.84 | 2047.12 | 2034.85 |
| | H | 8 | 0 | 0 | KP | 8 | 32 | 7 | 2167.34 | 2179.02 | 2168.94 |

NOTES: ① wrote in wrong location. D22 for 50415 E.

*Note: If Number larvae weighed differs from Surviving # Larvae then it is a Result of an organism that has pupated [judged to be a pupae]

Date/Init (Initial Weights): 8/9/17 EB

IN (Date/Time/Temp/Init): 8/11/17 17:14 88°C JW

OUT (Date/Time/Temp/Init): KP 8.12.17 1245 90°C



Aquatec Environmental, Inc.

Reviewed by: JW Date: 8/25/17

SDG: 15151

Project 17022

# 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Surviving # L | P | E | INIT | Total Surviving | Crucible Number | Number weighed | Initial Crucible | Final Crucible | Ashed Crucible |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **50418** | A | 7 | 0 | 1 | KP | 8 | 33 | 6 | 2157.91 | 2172.05 | 2160.19 |
| SED7F00EN | B | 7 | 0 | 1 | KP | 8 | 34 | 7 | 2182.67 | 2198.71 | 2185.35 |
| | C | 9 | 0 | 0 | EB | 9 | 35 | 9 | 2058.36 | 2078.14 | 2061.64 |
| | D | 6 | 2 | 1 | JW | 9 | 36 | 6 | 2195.10 | 2208.00 | 2197.59 |
| | E | 8 | 1 | 0 | JW | 9 | 37 | 8 | 2111.52 | 2128.59 | 2115.46 |
| | F | 8 | 1 | 1 | KP | 10 | 38 | 8 | 2194.36 | 2211.14 | 2197.63 |
| | G | 9 | 0 | 0 | EB | 9 | 39 | 9 | 2204.65 | 2226.28 | 2208.70 |
| | H | 5 | 0 | 3 | KP | 8 | 40 | 5 | 2219.37 | 2232.01 | 2221.08 |
| **50419** | A | 10 | 0 | 0 | JW | 10 | 41 | 10 | 2116.70 | 2137.60 | 2122.86 |
| SED7.5E00EN | B | 10 | 0 | 0 | EB | 10 | 42 | 10 | 2053.25 | 2075.08 | 2058.74 |
| | C | 9 | 0 | 0 | EB | 9 | 43 | 9 | 2184.03 | 2203.29 | 2187.15 |
| | D | 7 | 1 | 0 | EB | 8 | 44 | 7 | 2138.64 | 2156.50 | 2143.12 |
| | E | 10 | 0 | 0 | EB | 10 | 45 | 10 | 2204.97 | 2220.40 | 2207.35 |
| | F | 8 | 1 | 0 | JW | 9 | 46 | 8 | 2190.21 | 2207.66 | 2193.91 |
| | G | 8 | 1 | 1 | KP | 10 | 47 | 8 | 2181.66 | 2197.41 | 2185.23 |
| | H | 7 | 0 | 1 | KP | 8 | 48 | 6 | 2223.00 | 2235.22 | 2224.79 |
| **50420** | A | 10 | 0 | 0 | EB | 10 | 49 | 10 | 2175.49 | 2198.79 | 2180.89 |
| SED6.5E00EN | B | 6 | 0 | 2 | JW | 8 | 50 | 6 | 2208.29 | 2222.76 | 2211.32 |
| | C | 7 | 2 | 0 | KP | ~~8~~ 9 | 51 | 7 | 2165.83 | 2180.75 | 2167.40 |
| | D | 6 | 1 | 0 | KP | 7 | 52 | 6 | 2456.20 | 2474.78 | 2459.82 |
| | E | 7 | 2 | 1 | JW | 10 | 53 | 7 | 2142.99 | 2157.79 | 2146.15 |
| | F | 8 | 1 | 1 | JW | 10 | 54 | 8 | 2105.90 | 2124.40 | 2111.22 |
| | G | 7 | 0 | 1 | KP | 8 | 55 | 7 | 2111.16 | 2127.79 | 2114.35 |
| | H | 9 | 0 | 1 | KP | 10 | 56 | 9 | 2112.86 | 2134.34 | 2117.45 |
| **50421** | A | 9 | 0 | 1 | JW | 10 | 57 | 8 | 2018.96 | 2039.98 | 2024.45 |
| SED7E00EN | B | 9 | 0 | 1 | JW | 10 | 58 | 9 | 2224.39 | 2243.29 | 2228.16 |
| | C | 7 | 0 | 1 | EB | 8 | 59 | 7 | 2173.63 | 2191.22 | 2178.52 |
| | D | 9 | 1 | 0 | EB | 10 | 60 | 8 | 2111.23 | 2128.78 | 2114.79 |
| | E | 7 | 1 | 1 | KP | 9 | 61 | 7 | 2125.34 | 2140.17 | 2128.31 |
| | F | 9 | 0 | 1 | KP | 10 | 62 | 9 | 2100.09 | 2120.11 | 2103.95 |
| | G | 8 | 0 | 2 | JW | 10 | 63 | 8 | 2180.71 | 2199.80 | 2185.26 |
| | H | 8 | 0 | 0 | EB | 8 | 64 | 8 | 2201.19 | 2219.81 | 2205.45 |

EB 8/16/17

EB 8/17/17

NOTES:

*Note: If number larvae weighed differs from surviving # Larvae then it is a result of an organism judged to be a pupae

Date/Init (Initial Weights): 8/9/17 EB

IN (Date/Time/Temp/Init): 8/1/17 17:14 23°C JW

OUT (Date/Time/Temp/Init): KP 8.12.17 1245 20°C



Aquatec Environmental, Inc.

Reviewed by: JW Date: 8/25/17



SDG: 15151

Project 17022

**100.2** **Midge, C. dilutus, 10-D Survival and Growth**

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

**SEDIMENT TEST DATA:**

| Sample Number | REP | Surviving # L | P | E | INIT | Total Surviving | Crucible Number | Number weighed | Initial Crucible | Final Crucible | Ashed Crucible |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **50422** SED6B00EN | A | 9 | 1 | 0 | KP | 10 | 65 | 9 | 2140.55 | 2161.55 | 2145.53 |
| | B | 7 | 0 | 1 | KP | 8 | 66 | 7 | 2281.97 | 2297.93 | 2285.49 |
| | C | 7 | 0 | 1 | EB | 8 | 67 | 7 | 2063.26 | 2083.43 | 2069.21 |
| | D | 7 | 2 | 1 | JW | 10 | 68 | 7 | 2021.08 | 2035.97 | 2024.78 |
| | E | 6 | 1 | 2 | KP | 9 | 69 | 6 | 2193.39 | 2208.11 | 2196.89 |
| | F | 7 | 1 | ~~1~~ 2 | JW | 10 | 70 | 7 | 2196.48 | 2214.72 | 2200.73 |
| | G | 9 | 0 | 1 | JW | 10 | 71 | 8 | 2145.04 | 2162.86 | 2149.53 |
| | H | 6 | 2 | 1 | KP | 9 | 72 | 6 | 2306.45 | 2321.46 | 2309.51 |
| **50423** SED6A00EN | A | 5 | 2 | 0 | KP | 7 | 73 | 4 | 2533.80 | 2544.52 | 2535.91 |
| | B | 6 | 1 | 0 | EB | 7 | 74 | 6 | 2202.60 | 2219.01 | 2205.81 |
| | C | 8 | 1 | 0 | KP | 9 | 75 | 8 | 2187.84 | 2204.08 | 2190.81 |
| | D | 9 | 0 | 0 | JW | 9 | 76 | 9 | 2242.08 | 2259.73 | 2246.28 |
| | E | 10 | 0 | 0 | EB | 10 | 77 | 10 | 2046.35 | 2066.62 | 2050.05 |
| | F | 9 | 0 | 0 | EB | 9 | 78 | 9 | 2119.54 | 2143.49 | 2125.50 |
| | G | 7 | 1 | 2 | JW | 10 | 79 | 7 | 2188.67 | 2207.57 | 2195.30 |
| | H | 3 | 3 | ~~2~~ 3 JW | JW | 9 | 80 | 3 | 2119.68 | 2129.45 | 2121.78 |
| **50424** SED7.5D00EN | A | 7 | 1 | 1 | AW | 9 | 81 | 7 | 2174.34 | 2190.71 | 2178.87 |
| | B | 7 | 1 | 0 | KP | 8 | 82 | 7 | 2157.00 | 2174.42 | 2161.76 |
| | C | 9 | 1 | 0 | KP | 10 | 83 | 9 | 2092.16 | 2108.99 | 2096.47 |
| | D | 8 ~~9~~ | 0 | 1 | EB | 9 ~~10~~ | 84 | 7 | 2434.71 | 2449.83 | 2438.53 |
| | E | 5 | 2 | 0 | JW | 7 | 85 | 5 | 2255.21 | 2267.91 | 2258.05 |
| | F | 6 | 3 | 0 | KP | 9 | 86 | 6 | 2068.78 | 2081.98 | 2071.02 |
| | G | 7 | 1 | 0 | KP | 8 | 87 | 7 | 2245.47 | 2261.58 | 2248.59 |
| | H | 10 | 0 | 0 | EB | 10 | 88 | 10 | 2208.05 | 2228.99 | 2212.83 |
| **50425** SED7D00EN | A | 7 | 0 | 2 | JW | 9 | 89 | 7 | 2101.40 | 2119.13 | 2106.53 |
| | B | 7 | 2 | 1 | EB | 10 | 90 | 7 | 2221.89 | 2240.25 | 2227.55 |
| | C | 7 | 2 | 0 | EB | 9 | 91 | 7 | 2195.78 | 2214.27 | 2202.56 |
| | D | 6 | 1 | 1 | JW | 8 | 92 | 6 | 2120.94 | 2139.09 | 2126.93 |
| | E | 8 | 0 | 1 | KP | 9 | 93 | 8 | 2292.15 | 2309.43 | 2295.66 |
| | F | 7 | 1 | 1 | KP | 9 | 94 | 7 | 2211.01 | 2227.23 | 2215.05 |
| | G | 2 | 3 | X2 | EB | 7 | 95 | 2 | 2158.28 | 2164.29 | 2159.13 |
| | H | 8 | 1 | 1 | JW | 10 | 96 | 8 | 2145.21 | 2163.20 | 2149.99 |

NOTES:

*Note: If number larvae weighed differs from surviving # Larvae then it is a result of an organism that has been judged to be a pupae

| | |
|---|---|
| Date/Init (Initial Weights): | 8/9/17 EB |
| IN (Date/Time/Temp/Init): | 8/11/17 17:14 88°C JW |
| OUT (Date/Time/Temp/Init): KP | 8.12.17 1245 90°C |



**Aquatec Environmental, Inc.**
Reviewed by: JW Date: 8/25/17

SDG: 15151
Project 17022

# 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Surviving # L | P | E | INIT | Total Surviving | Crucible Number | Number weighed | Initial Crucible | Final Crucible | Ashed Crucible |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **50426** ED6.5D00EN | A | 8 | 1 | 0 | KP | 9 | 97 | 8 | 2210.23 | 2226.31 | 2213.52 |
| | B | 7 | 0 | 0 | [illegible] | 7 | 98 | 7 | 2333.21 | 2354.81 | 2340.68 |
| | C | 8 | 1 | 0 | EB | 9 | 99 | 8 | 2213.80 | 2231.22 | 2218.04 |
| | D | 6 | 0 | 2 | [illegible] | 8 | 100 | 6 | 2429.67 | 2444.87 | 2433.46 |
| | E | 5 | 1 | 1 | KP | 7 | 101 | 5 | 2376.13 | 2390.31 | 2379.17 |
| | F | 6 | 0 | 1 | [illegible] | 7 | 102 | 6 | 2345.83 | 2362.15 | 2350.34 |
| | G | 9 | 0 | 1 | KP | 10 | 103 | 9 | 2328.45 | 2343.96 | 2331.77 |
| | H | 7 | 2 | 0 | KP | 9 | 104 | 7 | 2391.74 | 2407.34 | 2396.27 |
| **50427** SED8A00EN | A | 4 | 2 | 2 | [illegible] | 8 | 105 | 4 | 2462.99 | 2476.02 | 2467.02 |
| | B | 4 | 0 | 2 | [illegible] | 6 | 106 | 4 | 2354.57 | 2366.13 | 2356.99 |
| | C | 7 | 1 | 0 | EB | 8 | 107 | 7 | 2409.63 | 2428.50 | 2413.79 |
| | D | 8 | 1 | 0 | KP | 9 | 108 | 6 | 2357.68 | 2373.14 | 2360.36 |
| | E | 10 | 0 | 0 | KP | 10 | 109 | 10 | 2322.37 | 2343.17 | 2325.07 |
| | F | 8 | 0 | 2 | [illegible] | 10 | 110 | 8 | 2256.12 | 2273.99 | 2261.18 |
| | G | 5 | 0 | 2 | [illegible] | 7 | 111 | 5 | 2353.67 | 2364.60 | 2355.23 |
| | H | 8 | 0 | 2 | [illegible] | 10 | 112 | 8 | 2206.96 | 2223.49 | 2210.73 |
| **50428** SED7A00EN | A | 8 | 1 | 1 | KP | 10 | 113 | 8 | 2374.84 | 2391.69 | 2377.49 |
| | B | 6 | 1 | 1 | EB | 8 | 114 | 6 | 2139.07 | 2155.16 | 2142.61 |
| | C | 9 | 0 | 1 | KP | 10 | 115 | 9 | 2164.81 | 2183.72 | 2168.43 |
| | D | 6 | 1 | 1 | [illegible] | 8 | 116 | 6 | 2262.71 | 2274.73 | 2264.08 |
| | E | 5 | 1 | 2 | EB | 8 | 117 | 5 | 2481.27 | 2493.86 | 2484.17 |
| | F | 8 | 0 | 0 | [illegible] | 8 | 118 | 8 | 2330.40 | 2350.13 | 2334.55 |
| | G | 7 | 0 | 1 | KP | 8 | 119 | 7 | 2320.90 | 2337.99 | 2323.78 |
| | H | 10 | 0 | 0 | KP | 10 | 120 | 10 | 2168.30 | 2189.29 | 2171.95 |
| **50429** SED8B00EN | A | 8 | 1 | 0 | KP | 9 | 121 | 8 | 2259.73 | 2281.62 | 2266.05 |
| | B | 7 | 2 | 0 | KP | 9 | 122 | 7 | 2424.95 | 2443.35 | 2429.48 |
| | C | 6 | 1 | 1 | EB | 8 | 123 | 6 | 2226.23 | 2242.71 | 2230.96 |
| | D | 10 | 0 | 0 | KP | 10 | 124 | 10 | 2224.61 | 2247.50 | 2229.58 |
| | E | ~~5~~ 9 | 9 | 1 | KP | 10 | 125 | 9 | 2371.43 | 2390.01 | 2374.08 |
| | F | 5 | 1 | 1 | [illegible] | 7 | 126 | 5 | 2349.43 | 2362.13 | 2353.08 |
| | G | 5 | 3 | 0 | KP | 8 | 127 | 5 | 2402.17 | 2413.47 | 2404.32 |
| | H | 8 | 0 | 2 | KP | 10 | 128 | 8 | 2287.93 | 2306.54 | 2290.94 |

NOTES:

*Note: If number larvae weighed differs from Surviving # larvae then it is a Result of an organism that has been judged to be a Pupae

Date/Init (Initial Weights): 8/9/17 EB

IN (Date/Time/Temp/Init): 8/11/17 17:14 88°C [illegible]

OUT (Date/Time/Temp/Init): KP 8.12.17 1245 90°C



**Aquatec Environmental, Inc.**

Reviewed by: [illegible] Date: 8/25/17



SDG: 15151

Project 17022

# 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Surviving # L | Surviving # P | Surviving # E | INIT | Total Surviving | Crucible Number | Number weighed | Initial Crucible | Final Crucible | Ashed Crucible |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **50430** SEDBACK1600N | A | 5 | 1 | 2 | EB | 8 | 129 | 5 | 2398.13 | 2415.69 | 2400.62 |
| | B | 6 | 1 | 1 | KP | 8 | 130 | 6 | 2434.86 | 2451.81 | 2437.21 |
| | C | 6 | 0 | 1 | JW | 7 | 131 | 6 | 2327.95 | 2344.06 | 2330.84 |
| | D | 8 | 1 | 0 | KN | 9 | 132 | 8 | 2243.07 | 2262.81 | 2246.15 |
| | E | 5 | 2 | 0 | KP | 7 | 133 | 5 | 2243.43 | 2257.26 | 2244.85 |
| | F | 9 | 0 | 0 | KP | 9 | 134 | 8 | 2337.33 | 2358.25 | 2341.15 |
| | G | 8 | 1 | 1 | JW | 10 | 135 | 8 | 2283.65 | 2306.21 | 2286.87 |
| | H | 7 | ~~0~~ 1 JW | 1 | JW | ~~8~~ 9 JW | 136 | 7 | 2385.81 | 2404.22 | 2388.88 |
| **50431** SEDBACK1700N | A | 5 | 2 | 1 | KP | 8 | 137 | 5 | 2266.97 | 2277.76 | 2268.90 |
| | B | 6 | 1 | 2 | KP | 9 | 138 | 6 | 2299.66 | 2312.07 | 2302.40 |
| | C | 7 | 0 | 3 | KP | 10 | 139 | 7 | 2376.12 | 2391.41 | 2378.81 |
| | D | 9 | 0 | 0 | KP | 9 | 140 | 9 | 2255.85 | 2276.07 | 2261.25 |
| | E | 8 | 1 | 0 | KP | 9 | 141 | 8 | 2261.49 | 2281.55 | 2266.02 |
| | F | 8 | 1 | 0 | KP | 9 | 142 | 8 | 2192.91 | 2210.04 | 2196.37 |
| | G | 10 | 0 | 0 | KP | 10 | 143 | 10 | 2366.09 | 2391.51 | 2372.46 |
| | H | 5 | 2 | 1 | KP | 8 | 144 | 5 | 2177.66 | 2189.89 | 2179.92 |
| **50432** SEDBACK1800N | A | 8 | 1 | 0 | KP | 9 | 145 | 8 | 2225.23 | 2245.18 | 2229.04 |
| | B | 8 | 0 | 1 | KP | 9 | 146 | 8 | 2418.85 | 2439.27 | 2422.97 |
| | C | 8 | 1 | 1 | KP | 10 | 147 | 8 | 2278.78 | 2293.81 | 2281.66 |
| | D | 5 | 1 | 2 | KP | 8 | 148 | 5 | 2405.27 | 2418.58 | 2408.08 |
| | E | 6 | 1 | 1 | KP | 8 | 149 | 6 | 2274.42 | 2292.05 | 2277.99 |
| | F | 8 | 2 | 0 | KP | 10 | 150 | 8 | 2353.14 | 2370.38 | 2356.47 |
| | G | 4 | 1 | 2 | KP | 7 | 151 | 4 | 2345.72 | 2357.78 | 2348.04 |
| | H | 5 | 2 | 1 | KP | 8 | 152 | 5 | 2432.92 | 2446.10 | 2435.04 |
| **50433** SEDBACK1900N | A | ~~9~~ 8 KP | 0 | 2 | KP | ~~10~~ 11 | 153 | 9 | 2337.31 | 2359.92 | 2342.43 |
| | B | 8 | 3 | 0 | KP | 11 | 154 | 8 | 2300.24 | 2313.94 | 2302.56 |
| | C | 8 | 1 | 1 | EB | 10 | 155 | 8 | 2332.18 | 2350.41 | 2336.94 |
| | D | 9 | 0 | 1 | EB | 10 | 156 | 9 | 2283.81 | 2307.90 | 2290.11 |
| | E | 9 | 0 | 0 | EB | 9 | 157 | 9 | 2443.42 | 2465.03 | 2449.19 |
| | F | 8 | 0 | 1 | KN | 9 | 158 | 8 | 2366.56 | 2385.83 | 2372.71 |
| | G | 4 | 1 | 3 | KP | 8 | 159 | 4 | 2226.11 | 2238.99 | 2229.54 |
| | H | 5 | 1 | 0 | KP | 6 | 160 | 5 | 2279.53 | 2295.71 | 2282.95 |

NOTES:

*Note If number larvae weighed differs from surviving # larvae then it is a Result of an organism that has been judged as a Pupae

Date/Init (Initial Weights): 8/9/17 EB

IN (Date/Time/Temp/Init): 8/1/17 17:14 88°C JW

OUT (Date/Time/Temp/Init): KP 8.12.17 1245 90°C



Aquatec Environmental, Inc.

Reviewed by: JW Date: 8/25/17

SDG: 15151

Project 17022

# Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Surviving # L | P | E | INIT | Total Surviving | Crucible Number | Number weighed | Initial Crucible | Final Crucible | Ashed Crucible |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **50434** | A | 8 | 0 | 1 | KP | 9 | 161 | 8 | 2206.93 | 2226.64 | 2210.34 |
| SEDBACK2000N | B | 8 | 1 | 0 | KP | 9 | 162 | 8 | 2236.75 | 2255.22 | 2240.17 |
| | C | 6 | 2 | 1 | EB | 9 | 163 | 6 | 2403.79 | ①~~2418.68~~ | 2407.59 |
| | D | 3 | 3 | 1 | EB | 7 | 164 | 3 | 2397.78 | 2407.67 | 2399.66 |
| | E | 8 | 0 | 1 | KP | 9 | 165 | 8 | 2494.64 | 2517.56 | 2500.62 |
| | F | 7 | 1 | 1 | KP | 9 | 166 | 7 | 2282.77 | 2299.13 | 2286.26 |
| | G | 9 | 1 | 0 | KP | 10 | 167 | 9 | 2426.65 | 2447.80 | 2430.66 |
| | H | 6 | 0 | 0 | KP | 6 | 168 | 6 | 2216.36 | 2234.17 | 2220.74 |

NOTES: ① 2419.68

| | |
|---|---|
| Date/Init (Initial Weights): | 8/9/17 EB |
| IN (Date/Time/Temp/Init): | 8/11/17 17:14 88°C [illegible] |
| OUT (Date/Time/Temp/Init): KP | 8.12.17 1245 90°C |



Aquatec Environmental, Inc.

Reviewed by: [illegible] Date: 8/25/17

SDG: 15151

Project 17022

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

AQUATIC BIO SYSTEMS ABS INC.

Toll Free: 800/331-5916
Tel:970/484-5091 Fax:970/484-2514

## ORGANISM HISTORY

Rec on 8/1/2017 OW
pH 6.9
D.O 10.0
Conductivity 372
Temp. 24.2

DATE: 7/31/2017

SPECIES: *Chironomus dilutus (formerly C. tentans)*

AGE: Deposited 07/22/2017

LIFE STAGE: Second Instar 08/02/2017

HATCH DATE: Emergent date 08/15/2017

BEGAN FEEDING: Immediately

FOOD: *Raphidocelis subcapitata*.*, Flake slurry

Condition Normal / Tubed
OW

| Water Chemistry Record: | Current | Range |
|---|---|---|
| TEMPERATURE: | 24°C | 23-26°C |
| SALINITY/CONDUCTIVITY: | -- | -- |
| TOTAL HARDNESS (as $CaCO_3$): | 134 mg/l | 100-190 mg/l |
| TOTAL ALKALINITY (as $CaCO_3$): | 75 mg/l | 50-100 mg/l |
| pH: | 8.20 | 7.88-8.20 |

**Comments:** * Formerly known as *Psuedokirschneriella subcapitata* and *Selenastrum capricornutum*

*Facility Supervisor*

**Aquatic BioSystems, Inc • Quality Research Organisms**

# Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960



AECOM
250 Apollo Drive

Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com


**Client ID:** AECOM/Kennedy

## ORGANISM HOLDING AND ACCLIMATION

Species: *Chironomus dilutus*
Supplier: ABS
Conditio: Normal / Tubed

Date Received: 8/1/17
Age of Organism: ~ 8 DAYS
Culture ID: 080117 CD

Acclimation / Holding Procedures: Transfer to holding culture boxes, add laboratory water. Acclimate to water to be used for testing (sediment overlying water formulation). Aerate lightly. Water change at least once (50 %) every two days.

Daily Feeding: Tetrafin slury. Do Not allow excess food to accumulate.

| Date | Fed | Temp. | pH | D.O. | Cond. | Condition | Water Change | Initials |
|---|---|---|---|---|---|---|---|---|
| 8/1/17 | ✓ | 24.2 | 6.9 | 10.0 | 372 | Normal | ✓ | R |
| __/__/__ | | | | | | | | |
| __/__/__ | | | | | | | | |
| __/__/__ | | | | | | | | |
| __/__/__ | | | | | | | | |

*N = Normal, appear healthy. Record # dead if any observed.*

### *Chironomus dilutus* Head capsule measurements

| Organism | Head Capsule Width (mm) | Organism | Head Capsule Width (mm) |
|---|---|---|---|
| 1 | 0.41 | 11 | 0.39 |
| 2 | 0.38 | 12 | 0.33 |
| 3 | 0.36 | 13 | 0.36 |
| 4 | 0.40 | 14 | 0.38 |
| 5 | 0.36 | 15 | 0.34 |
| 6 | 0.38 | 16 | 0.35 |
| 7 | 0.67 | 17 | 0.75 |
| 8 | 0.35 | 18 | 0.37 |
| 9 | 0.36 | 19 | 0.35 |
| 10 | 0.35 | 20 | 0.38 |
| Initials | KP | Initials | KP |
| Date | 9.15.17 | Date | 9.15.17 |

***Chironomus dilutus* Head Capsule Width**
**AECOM Pepco Benning** **SDG 1511€** 15151
***Chironomus dilutus* 10-day survival and growth test**
Culture ID: 080117Cd Age: 8-9 days
Straightline measurement from eye to eye across to edges of head capsule.
Source of Organisms: Aquatic BioSystems
Organisms from cultures used for testing on 8/1/17 (subsample preserved until time of measurement)

| Organism Number | Head Capsule Width (mm) |
|---|---|
| 1 | 0.41 |
| 2 | 0.38 |
| 3 | 0.36 |
| 4 | 0.4 |
| 5 | 0.36 |
| 6 | 0.38 |
| 7 | 0.67 |
| 8 | 0.35 |
| 9 | 0.36 |
| 10 | 0.35 |
| 11 | 0.39 |
| 12 | 0.33 |
| 13 | 0.36 |
| 14 | 0.38 |
| 15 | 0.34 |
| 16 | 0.35 |
| 17 | 0.75 |
| 18 | 0.37 |
| 19 | 0.35 |
| 20 | 0.38 |

| **Average:** | **0.40** | **mm** |
|---|---|---|

Reviewed by: JW
Review date: 9/15/17

**100.2** **Midge, C. dilutus, 10-D Survival and Growth**

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

**ASH-FREE DATA:** **PRE-ASHING - BALANCE QC/TEMPERATURE**

**BATCH 1:**

**IN Furnace:**
Date: 8 / 6 / 17 Time: 13 : 00 Temp: 550 °C Initials: [illegible]

**OUT Furnace:**
Date: 8 / 6 / 17 Time: 15 : 00 Temp: 550 °C Initials: [illegible]

**NOTES:** Crucibles 1-25

**BATCH 2:**

**IN Furnace:**
Date: 8 / 7 / 17 Time: 11 : 57 Temp: 550 °C Initials: [illegible]

**OUT Furnace:**
Date: 8 / 7 / 17 Time: 14 : 04 Temp: 550 °C Initials: [illegible]

**NOTES:** 26-75

**BATCH 3:**

**IN Furnace:**
Date: 8 / 7 / 17 Time: 14 : 05 Temp: 550 °C Initials: [illegible]

**OUT Furnace:**
Date: 8 / 7 / 17 Time: 17 : 05 Temp: 550 °C Initials: [illegible]

**NOTES:** 76-125

**BATCH 4:**

**IN Furnace:**
Date: 8 / 8 / 17 Time: 14 : 15 Temp: 552 °C Initials: [illegible]

**OUT Furnace:**
Date: 8 / 8 / 17 Time: 16 : 26 Temp: 552 °C Initials: [illegible]

**NOTES:** Crucibles 126-175

# 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

## ASH-FREE DATA:

**ASHING - BALANCE QC/TEMPERATURE**

### BATCH 1:

**IN Furnace:**

Date: 8/14/17 Time: 09:13 Temp: 551 °C Initials: ow

**OUT Furnace:**

Date: 8/14/17 Time: 11:23 Temp: 549 °C Initials: ow

**NOTES:** Crucibles 1-25

### BATCH 2:

**IN Furnace:**

Date: 8/16/17 Time: 09:50 Temp: 549 °C Initials: ow

**OUT Furnace:**

Date: 8/16/17 Time: 12:00 Temp: 549 °C Initials: ow

**NOTES:** Crucibles 26-50

### BATCH 3:

**IN Furnace:**

Date: 8/16/17 Time: 12:10 Temp: 550 °C Initials: ow

**OUT Furnace:**

Date: 8/16/17 Time: 14:23 Temp: 549 °C Initials: ow

**NOTES:** Crucibles 51-75

### BATCH 4:

**IN Furnace:**

Date: 8/16/17 Time: 14:25 Temp: 550 °C Initials: ow

**OUT Furnace:**

Date: 8/16/17 Time: 16:36 Temp: 549 °C Initials: ow

**NOTES:** Crucibles 76-100

### BATCH 5:

**IN Furnace:**

Date: 8/17/17 Time: 08:20 Temp: 549 °C Initials: ow

**OUT Furnace:**

Date: 8/17/17 Time: 11:11 Temp: 549 °C Initials: ow

**NOTES:** Crucibles 101-125

### BATCH 6:

**IN Furnace:**

Date: 8/17/17 Time: 11:14 Temp: 549 °C Initials: ow

**OUT Furnace:**

Date: 8/17/17 Time: 13:27 Temp: 549 °C Initials: EB

**NOTES:** Crucibles 126-150

Batch 7

In Furnace 8/17/17 Time: 13:28 Temp 549°C EB

OUT Furnace 8/17/17 Time: 15:43 Temp 549°C EB

**Aquatec Environmental, Inc.**

Reviewed by: ow Date: 9/10/17

SDG: 15151

Project 17022

| **100.2** | **Midge, C. dilutus, 10-D Survival and Growth** |
|---|---|

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

**CHEMISTRY MONITORING:**



| Sample | Analysis | KN 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **50413** CONTROL | pH | 7.7 | — | | | | | | | | 7.7 | |
| | DO | 7.0 | 5.6 | 5.4 | 7.5 | 7.2 | 7.7 | 7.5 | 7.6 | 7.3 | 6.7 | 7.6 |
| | Cond. | 329 | — | | | | | | | | 361 | |
| **50415** SED6C00EN | pH | 7.6 | | | | | | | | | 7.6 | |
| | DO | 6.2 | 5.1 | 5.3 | 7.4 | 7.6 | 7.7 | 7.6 | 7.4 | 7.1 | 6.9 | 6.6 |
| | Cond. | 392 | | | | | | | | | 365 | |
| **50416** SED8C00EN | pH | 7.5 | | | | | | | | | 7.6 | |
| | DO | 6.3 | 6.0 | 6.1 | 7.4 | 7.3 | 7.6 | 7.6 | 7.3 | 7.2 | 6.8 | 7.4 |
| | Cond. | 371 | | | | | | | | | 364 | |
| **50417** SED7B00EN | pH | 7.5 | | | | | | | | | 7.5 | |
| | DO | 5.6 | 5.1 | 5.9 | 7.5 | 7.3 | 7.4 | 7.6 | 7.2 | 7.2 | 6.4 | 6.7 |
| | Cond. | 395 | | | | | | | | | 368 | |
| **50418** SED7F00EN | pH | 7.5 | | | | | | | | | 7.6 | |
| | DO | 6.2 | 4.8 | 6.1 | 6.7 | 6.8 | 7.0 | 7.3 | 6.8 | 6.3 | 6.7 | 6.0 |
| | Cond. | 379 | | | | | | | | | 378 | |
| **50419** SED7.5E00EN | pH | 7.5 | | | | | | | | | 7.7 | |
| | DO | 5.9 | 5.9 | 5.3 | 7.0 | 7.1 | 7.4 | 7.7 | 7.5 | 7.5 | 6.8 | 7.5 |
| | Cond. | 381 | | | | | | | | | 398 | |
| **50420** SED6.5E00EN | pH | 7.6 | | | | | | | | | 7.8 | |
| | DO | 5.9 | 4.6 | 4.6 | 6.5 | 7.2 | 7.4 | 7.7 | 7.3 | 7.3 | 6.8 | 7.1 |
| | Cond. | 387 | | | | | | | | | 392 | |
| **50421** SED7E00EN | pH | 7.6 | | | | | | | | | 7.7 | |
| | DO | 6.0 | 4.8 | 4.7 | 6.7 | 6.6 | 6.8 | 7.1 | 6.7 | 6.7 | 6.6 | 6.1 |
| | Cond. | 378 | | | | | | | | | 391 | |
| **50422** SED6B00EN | pH | 7.7 | | | | | | | | | 7.8 | |
| | DO | 6.1 | 5.2 | 4.0 | 4.4 | 7.5 | 7.5 | 7.4 | 7.7 | 7.6 | 6.9 | 7.6 |
| | Cond. | 399 | | | | | | | | | 373 | |
| **50423** SED6A00EN | pH | 7.4 | | | | | | | | | 7.8 | |
| | DO | 6.1 | 5.0 | 5.1 | 6.7 | 7.4 | 7.4 | 7.6 | 7.4 | 7.4 | 6.9 | 7.3 |
| | Cond. | 425 | | | | | | | | | 365 | |
| **50424** SED7.5D00EN | pH | 7.4 | | | | | | | | | 7.8 | |
| | DO | 5.8 | 5.0 | 5.9 | 7.0 | 7.2 | 6.9 | 7.5 | 7.0 | 6.8 | 6.5 | 6.6 |
| | Cond. | 346 | | | | | | | | | 378 | |

2017

↑ AERATION STARTED ALL SAMPLES/REPS

*Chemical analysis Date/Initials are noted on last page of Days 0 - 10 chemistry data sheets*

**Aquatec Environmental, Inc.**

Reviewed by: JW Date: 9/10/17

**SDG:** 15151

**Project** 17022

# 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

**CHEMISTRY MONITORING:**



| Sample | Analysis | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **50425** | pH | 7.4 | — | | | | | | | | 7.9 | |
| SED7D00EN | DO | 6.0 | 5.2 | 5.2 | 7.0 | 7.5 | 7.2 | 7.8 | 7.4 | 7.5 | 6.9 | 7.3 |
| | Cond. | 369 | — | | | | | | | | 384 | |
| **50426** | pH | 7.5 | | | | | | | | | 7.8 | |
| ED6.5D00EN | DO | 6.0 | 5.0 | 5.7 | 7.4 | 7.4 | 7.5 | 7.6 | 7.4 | 7.3 | 6.4 | 7.1 |
| | Cond. | 387 | | | | | | | | | 398 | |
| **50427** | pH | 7.4 | | | | | | | | | 7.8 | |
| SED8A00EN | DO | 6.1 | 5.4 | 5.5 | 7.4 | 7.4 | 7.6 | 7.7 | 7.4 | 7.2 | 6.7 | 7.1 |
| | Cond. | 392 | | | | | | | | | 367 | |
| **50428** | pH | 7.6 | | | | | | | | | 7.8 | |
| SED7A00EN | DO | 6.4 | 5.0 | 5.1 | 7.3 | 7.3 | 7.4 | 7.5 | 7.5 | 7.1 | 6.6 | 7.0 |
| | Cond. | 448 | | | | | | | | | 386 | |
| **50429** | pH | 7.5 | | | | | | | | | 7.8 | |
| SED8B00EN | DO | 4.7 | 4.0 | 4.9 | 6.8 | 7.1 | 7.3 | 7.4 | 7.4 | 6.9 | 6.6 | 6.8 |
| | Cond. | 429 | | | | | | | | | 377 | |
| **50430** | pH | 7.5 | | | | | | | | | 7.7 | |
| SEDBACK160 | DO | 5.9 | 5.2 | 4.7 | 6.7 | 6.5 | 6.8 | 7.5 | 7.2 | 6.8 | 5.9 | 6.0 |
| 0N | Cond. | 444 | | | | | | | | | 405 | |
| **50431** | pH | 7.3 | | | | | | | | | 7.8 | |
| SEDBACK170 | DO | 5.8 | 5.2 | 4.6 | 7.0 | 6.9 | 6.9 | 7.2 | 6.8 | 7.0 | 6.4 | 6.2 |
| 0N | Cond. | 431 | | | | | | | | | 376 | |
| **50432** | pH | 7.5 | | | | | | | | | 7.9 | |
| SEDBACK180 | DO | 5.8 | 5.1 | 6.6 | 7.2 | 6.6 | 7.2 | 7.4 | 7.1 | 7.3 | 6.7 | 6.8 |
| 0N | Cond. | 408 | | | | | | | | | 395 | |
| **50433** | pH | 7.6 | | | | | | | | | 7.9 | |
| SEDBACK190 | DO | 6.1 | 5.3 | 5.4 | 7.0 | 7.1 | 7.3 | 7.4 | 7.0 | 6.8 | 6.7 | 6.1 |
| 0N | Cond. | 404 | | | | | | | | | 366 | |
| **50434** | pH | 7.7 | | | | | | | | | 7.8 | |
| SEDBACK200 | DO | 6.7 | 5.5 | 5.7 | 6.9 | 7.4 | 7.4 | 7.3 | 6.7 | 6.9 | 6.4 | 6.6 |
| 0N | Cond. | 431 | | | | | | | | | 368 | |
| 2017 | Date | 8/1/17 | 8/2/17 | 8/3/17 | 8/4/17 | 8/5 | 8/6 | 8/7 | 8/8 | 8/9 | 8/10 | 8/11 |
| | Initials | EB | EB | KN | EB | KP | [illegible] | KN | KN | EB | KN | KN |

↑ Aeration started all samples/reps

*Chemical analysis Date/Initials are noted on last page of Days 0 - 10 chemistry data sheets*

**Aquatec Environmental, Inc.**

Reviewed by: [illegible] Date: 9/15/17

SDG: 15151

Project 17022

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

### DAILY SEDIMENT DO MONITORING:

(Rep/D.O. measurement)

| Sample Number | Day ~~1~~ 2 ow | ~~Day 2~~ | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50425 | | | | | | | | | | |
| 50415 | | | | | | | | | | |
| 50416 | | | | | | | | | | |
| 50417 | | | | | | | | | | |
| 50418 | | | | | | | | | | |
| 50419 | | | | | | | | | | |
| 50420 | | | | | | | | | | |
| 50421 | | | | | | | | | | |
| 50422 | 2.7 | Day 2 measurement ow | | | | | | | | |
| 50413 | 3.7 | | | | | | | | | |
| 50424 | | | | | | | | | | |
| 50434 | | | | | | | | | | |
| 50426 | | | | | | | | | | |
| 50427 | | | | | | | | | | |
| 50428 | | | | | | | | | | |
| 50429 | | | | | | | | | | |
| 50430 | | | | | | | | | | |
| 50431 | 3.4 | Day 2 measurement ow | | | | | | | | |
| 50432 | | | | | | | | | | |
| 50433 | | | | | | | | | | |

**Aquatec Environmental, Inc.**
Reviewed by: ow Date: 9/10/17

**SDG:** 15151
**Project** 17022

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy

### DAILY SEDIMENT DO MONITORING:

(Rep/D.O. measurement)

| Sample Number | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50423 | | | | | | | | | | |
| Initials/Date | | JW 8/3/17 | | | | | | | | |

Procedure: beginning on day 1, measure and record DO directly in two randomly selected replicates. Beginning on Day 4, measure and record DO directly in four randomly selected replicates (Try to check different sample #'s on each subsequent day). When a declining DO trend is seen in any replicate, begin aeration to all replicates on that day.

Sample 50422 has low D.O.
Started aeration to all test replicates JW 8/3/17



SDG: 15151
Project 17022

**Summary of temperature monitoring (°C)**
***Chironomus dilutus 10*** **-d survival and growth test (August 1-11, 2017)**
**Project: AECOM PEPCO BENNING**

| Date | Day of Test | Cart 1 a.m | Cart 2 a.m | Cart 3 a.m | Cart 1 p.m. | Cart 2 p.m. | Cart 3 p.m. | °C Day average |
|---|---|---|---|---|---|---|---|---|
| 8/1/2017 | 0 | 23.6 | 23.3 | 23.1 | 23.3 | 23.3 | 23.6 | 23.4 |
| 8/2/2017 | 1 | 23.2 | 23.3 | 23.8 | 23.3 | 23.2 | 23.8 | 23.4 |
| 8/3/2017 | 2 | 23.2 | 23.3 | 23.9 | 24 | 24 | 24.1 | 23.8 |
| 8/4/2017 | 3 | 23.5 | 23.3 | 23.8 | 23.4 | 23.5 | 23.8 | 23.6 |
| 8/5/2017 | 4 | 23.1 | 23.2 | 23.8 | 23.2 | 23.2 | 23.7 | 23.4 |
| 8/6/2017 | 5 | 23 | 23.1 | 23.5 | 23 | 23.1 | 23.6 | 23.2 |
| 8/7/2017 | 6 | 23 | 23.1 | 23.7 | 23.3 | 23.3 | 23.8 | 23.4 |
| 8/8/2017 | 7 | 23.2 | 23.2 | 23.8 | 23.2 | 23.2 | 24 | 23.4 |
| 8/9/2017 | 8 | 23 | 23.2 | 23.8 | 23.2 | 23.2 | 23.9 | 23.4 |
| 8/10/2017 | 9 | 23 | 23.3 | 23.9 | 23.3 | 23.3 | 23.9 | 23.5 |
| 8/11/2017 | 10 | 23.3 | 23.3 | 23.8 | Not measured (test ended) | | | 23.5 |
| | | **Cart 1 Avg. a.m.** | **Cart 2 Avg. a.m.** | **Cart 3 Avg. a.m.** | **Cart 1 Avg. p.m.** | **Cart 2 Avg. p.m.** | **Cart 3 Avg. p.m.** | |
| | | **23.2** | **23.2** | **23.7** | **23.3** | **23.3** | **23.8** | |

| | |
|---|---|
| **Overall average temperature:** | **23.4** |
| **Average daily low:** | **23.2** |
| **Average daily high:** | **23.8** |

JV 9/13/17

**100.2** **Midge, C. dilutus, 10-D Survival and Growth**

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy **WEEK OF:** 7/30/17

**DAILY SEDIMENT MONITORING - CHECKLIST:** **ACTIVITY / DAY**

| AM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | | / | 23.6 23.3 23.1 | 23.2 23.3 23.8 | 23.2 23.3 23.9 | 23.5 23.3 23.8 | 23.1 23.2 23.8 |
| Fill Reservoirs | | / | ✓ | ✓ | ✓ | ✓ | ✓ |
| Delivery tubes in place | | / | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check water Supply | | / | ✓ | ✓ | ✓ | ✓ | ✓ |
| Empty Waste Buckets | | / | ✓ | ✓ | ✓ | ✓ | ✓ |
| Floater/Aeration* Check | | / | — | ✓ | ✓ | ✓ | ✓ |
| Chems Collected / ok? | | / | ✓ | ✓ | ✓ | ✓ | ✓ |

| NOON | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Splitter box(s) filling? | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Syringes filing? | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Needles flowing? | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Drainage to Waste? | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Feeding (Time/Init.) | | | 13:35 EB | 15:13 EB | 13:34 EB | 14:44 EB | 1855 KP 4 |

| PM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | | | 23.3 23.3 23.6 | 23.3 23.2 23.8 | 24.0 24.0 24.1 | 23.4 23.5 23.8 | 23.2 23.2 23.7 |
| Fill Reservoirs | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Delivery tubes in place | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check water Supply | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Empty Waste Buckets | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Floater/Aeration* Check | | — | ✓ | ✓ | ✓ | ✓ | ✓ |
| Date: | | 7/31/17 | 8/1/17 | 8/2/17 | 8/3/17 | 8/4/17 | 8.5.17 |
| Initials: | | [illegible] | KN | EB | KN/EB | KN/EB | KP |

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| **Corrective Actions / Comments (Initial/Time)** * Aeration required if DO is below/reaching minimum DO | | Loaded sediments to beakers. Sample 50433 mostly stones. Omitted most stones → fluid red. OLW Added | TEST START 13:00 – 18:30 | | Started aeration to all test replicates | | |

**Aquatec Environmental, Inc.**

Reviewed by: [illegible] Date: 9/10/17

**SDG:** 15151
**Project** 17022

## 100.2 Midge, C. dilutus, 10-D Survival and Growth

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: SED-A-002

**Client ID:** AECOM/Kennedy **WEEK OF:** 8 / 6 / 17

**DAILY SEDIMENT MONITORING - CHECKLIST:** **ACTIVITY / DAY**

| AM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | 23.0 23.1 23.5 | 23.0 23.1 23.7 | 23.2 23.2 23.8 | 23.0 23.2 23.8 | 23.0 23.3 23.9 | 23.3 23.3 23.8 | |
| Fill Reservoirs | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Delivery tubes in place | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Check water Supply | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Empty Waste Buckets | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Floater/Aeration* Check | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Chems Collected / ok? | ✓ | ✓ | ✓ | ✓ | ✓ | / | |

| NOON | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Splitter box(s) filling? | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Syringes filing? | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Needles flowing? | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Drainage to Waste? | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Feeding (Time/Init.) | 14:50 | 15:25 KN | 14:01 EB | 13:14 EB | 15:15 KN | / | |

| PM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | 23.0 23.1 23.6 | 23.3 23.3 23.8 | 23.2 23.2 24.0 | 23.2 23.2 23.9 | 23.3 23.3 23.9 | / | |
| Fill Reservoirs | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Delivery tubes in place | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Check water Supply | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Empty Waste Buckets | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Floater/Aeration* Check | ✓ | ✓ | ✓ | ✓ | ✓ | / | |
| Date: | 8/6/17 | 8/7/17 | 8/8/17 | 8/9/17 | 8/10/17 | 8/11/17 | |
| Initials: | | / EB | KN/ | KN/ | | | |

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| **Corrective Actions / Comments (Initial/Time)** * Aeration required if DO is below/reaching minimum DO | | | | added Emergence traps 8/9/17 KN | 50430-B 1 fly | Test end 4:45pm [16:45] KN | |

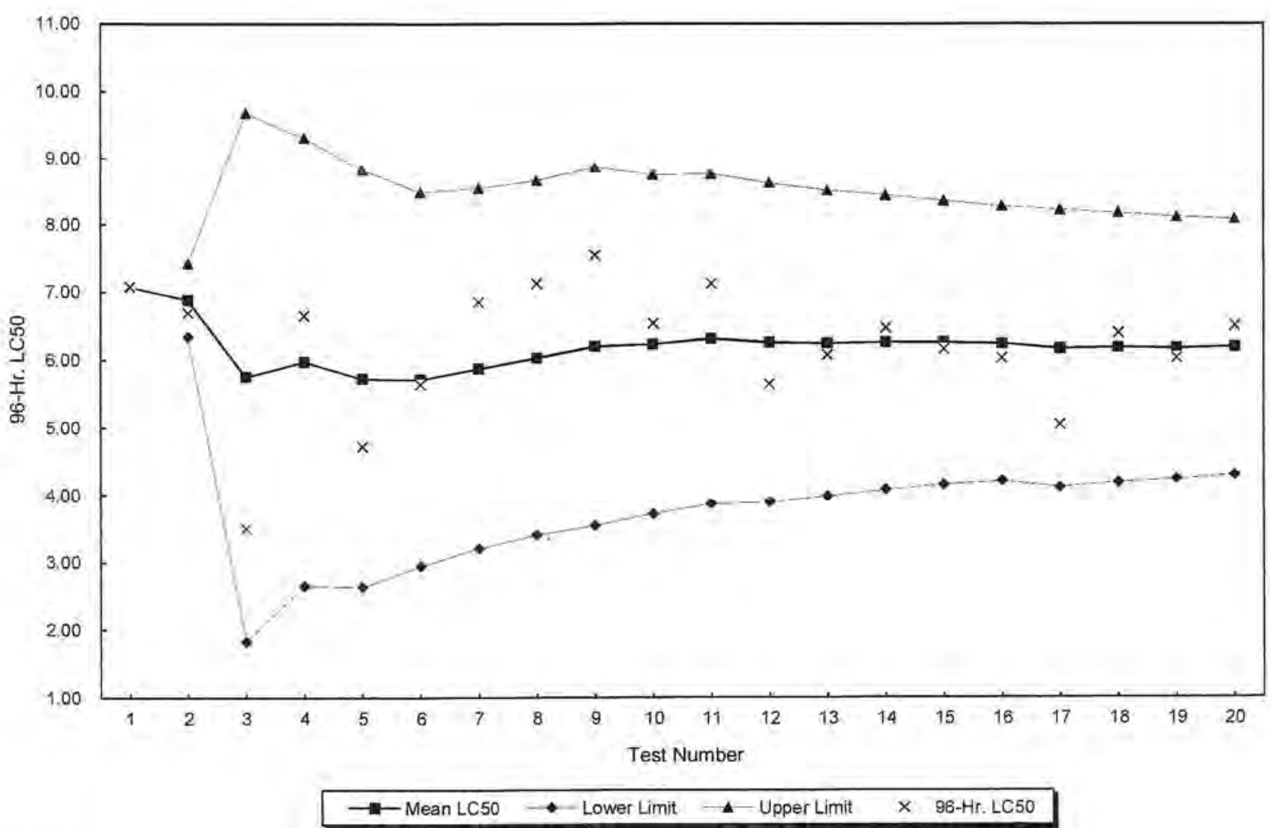


**SDG:** 15151
**Project** 17022

# Standard Reference Toxicant Control Chart(s)

# Reference Toxicant Control Chart
## *Chironomus dilutus*
## in Potassium chloride (g/L)

| Test Number | Test Date | Organism Age (Days) | 96-Hr. LC50 | Mean LC50 | Lower Limit | Upper Limit | Organism Source |
|---|---|---|---|---|---|---|---|
| 1 | 09/07/12 | 12 | 7.071 | 7.07 | | | Aquatec Biological Sciences |
| 2 | 10/17/12 | 12 | 6.689 | 6.88 | 6.34 | 7.42 | Aquatec Biological Sciences |
| 3 | 11/08/12 | 10 | 3.497 | 5.75 | 1.83 | 9.68 | Aquatic BioSystems |
| 4 | 12/07/12 | 10 | 6.647 | 5.98 | 2.65 | 9.30 | Aquatec Biological Sciences |
| 5 | 08/05/13 | 11 | 4.716 | 5.72 | 2.63 | 8.82 | Aquatec Biological Sciences |
| 6 | 11/08/13 | 9 | 5.638 | 5.71 | 2.94 | 8.48 | Aquatec Biological Sciences |
| 7 | 08/19/14 | 12 | 6.847 | 5.87 | 3.20 | 8.54 | Aquatec Biological Sciences |
| 8 | 10/17/14 | 12 | 7.124 | 6.03 | 3.40 | 8.65 | Aquatec Biological Sciences |
| 9 | 01/30/15 | 9 | 7.545 | 6.20 | 3.54 | 8.85 | Aquatec Biological Sciences |
| 10 | 02/03/15 | 15 | 6.531 | 6.23 | 3.72 | 8.74 | Aquatec Biological Sciences |
| 11 | 05/08/15 | 9 | 7.124 | 6.31 | 3.87 | 8.76 | Aquatic BioSystems |
| 12 | 06/30/15 | 10 | 5.638 | 6.26 | 3.89 | 8.62 | Aquatec Biological Sciences |
| 13 | 05/06/16 | 11 | 6.073 | 6.24 | 3.98 | 8.51 | Aquatec Biological Sciences |
| 14 | 05/10/16 | 16 | 6.466 | 6.26 | 4.08 | 8.44 | Aquatic BioSystems |
| 15 | 05/24/16 | 9 | 6.155 | 6.25 | 4.15 | 8.35 | Aquatic BioSystems |
| 16 | 12/16/16 | 9 | 6.020 | 6.24 | 4.20 | 8.27 | Aquatic BioSystems |
| 17 | 4/3/17-4/7/17 | 10 | 5.044 | 6.17 | 4.12 | 8.22 | Aquatic BioSystems |
| 18 | 6/7/17-6/11/17 | 9 | 6.394 | 6.18 | 4.19 | 8.17 | Aquatic BioSystems |
| 19 | 6/13/17-6/17/17 | 12 | 6.020 | 6.17 | 4.23 | 8.11 | Aquatic BioSystems |
| 20 | 8/1/17-8/5/17 | 8 | 6.497 | 6.19 | 4.30 | 8.08 | Aquatic BioSystems |




\SRTS\Ct KCL

**October 9, 2017**

Mr. Robert Kennedy and Maryann Welsch
Ecological Risk Assessment, Environmental
AECOM
250 Apollo Drive
Chelmsford, NH 01824

**Re: Report on sediment toxicity tests (Pepco Benning RI/FS Project), AECOM Project # 60340344, AECOM P.O. # 90384.**

Dear Mr. Kennedy and Ms. Welsch:

Attached please find the electronic copy (PDF) of the report and data package on the results of sediment toxicity tests completed on samples associated with the Pepco Benning RI/FS Project.

The original report for the *Hyalella azteca* 10-day survival and growth tests (EPA Method 100.1) had two missing pages (documentation of cooler temperatures when samples were received). The attached report includes those two pages within the Chain-of-Custody section.

Please do not hesitate to contact me if you have any questions and thank you for the opportunity to work with you on this project.

Sincerely,

John Williams

John W. Williams
Director

**This report consists of the following numbered pages:** SDG 15151 – 105pgs

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**Project:** Pepco Benning Road Facility

## TOXICITY SUMMARY REPORT:

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

| Sample Identification | | Control Group | Mean Percent Surviving (%) | | Mean Growth Weight (mg) | |
|---|---|---|---|---|---|---|
| 50413 | CONTROL | A | 95.0% | | 0.161 | |
| 50415 | SED6C00EN | A | 96.3% | | 0.141 | a |
| 50416 | SED8C00EN | A | 97.5% | | 0.139 | a,f |
| 50417 | SED7B00EN | A | 90.0% | d,e | 0.127 | a,c,d,f |
| 50418 | SED7F00EN | A | 96.3% | | 0.140 | a |
| 50419 | SED7.5E00EN | A | 98.8% | | 0.136 | a,f |
| 50420 | SED6.5E00EN | A | 96.3% | | 0.148 | |
| 50421 | SED7E00EN | A | 93.8% | | 0.132 | a,f |
| 50422 | SED6B00EN | A | 93.8% | | 0.149 | |
| 50423 | SED6A00EN | A | 95.0% | | 0.131 | a,f |
| 50424 | SED7.5D00EN | A | 96.3% | | 0.137 | a,f |
| 50425 | SED7D00EN | A | 93.8% | | 0.150 | |
| 50426 | SED6.5D00EN | A | 95.0% | | 0.150 | |
| 50427 | SED8A00EN | A | 98.8% | | 0.131 | a,f |
| 50428 | SED7A00EN | A | 93.8% | | 0.145 | |
| 50429 | SED8B00EN | A | 96.3% | | 0.143 | |
| 50430 | SEDBACK1600N | A | 83.8% | a | 0.115 | a |
| 50431 | SEDBACK1700N | A | 96.3% | | 0.150 | |
| 50432 | SEDBACK1800N | A | 97.5% | | 0.146 | |
| 50433 | SEDBACK1900N | A | 97.5% | | 0.143 | |
| 50434 | SEDBACK2000N | A | 91.3% | | 0.154 | |

*a) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the laboratory control (50413 - Control).*
*b) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50430 - SEDBACK1600N).*
*c) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50431 - SEDBACK1700N).*
*d) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50432 - SEDBACK1800N).*
*e) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference sample (50433 - SEDBACK1900N).*
*f) Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference control (50434 - SEDBACK2000N).*

## SAMPLES RECEIVED:

| Number | Sample Name | Date Time and Collected | Type |
|---|---|---|---|
| 50413 | CONTROL | | Control Sediment |
| 50415 | SED6C00EN | 6/7/2017 10:00:00 AM | Sediment |
| 50416 | SED8C00EN | 6/7/2017 11:30:00 AM | Sediment |
| 50417 | SED7B00EN | 6/7/2017 12:30:00 PM | Sediment |
| 50418 | SED7F00EN | 6/8/2017 8:30:00 AM | Sediment |
| 50419 | SED7.5E00EN | 6/8/2017 9:15:00 AM | Sediment |
| 50420 | SED6.5E00EN | 6/8/2017 10:00:00 AM | Sediment |
| 50421 | SED7E00EN | 6/8/2017 10:30:00 AM | Sediment |
| 50422 | SED6B00EN | 6/8/2017 12:30:00 PM | Sediment |
| 50423 | SED6A00EN | 6/8/2017 1:15:00 PM | Sediment |
| 50424 | SED7.5D00EN | 6/9/2017 8:15:00 AM | Sediment |
| 50425 | SED7D00EN | 6/9/2017 9:15:00 AM | Sediment |
| 50426 | SED6.5D00EN | 6/9/2017 9:45:00 AM | Sediment |
| 50427 | SED8A00EN | 6/9/2017 10:30:00 AM | Sediment |
| 50428 | SED7A00EN | 6/9/2017 11:15:00 AM | Sediment |
| 50429 | SED8B00EN | 6/9/2017 12:00:00 PM | Sediment |
| 50430 | SEDBACK1600N | 6/12/2017 10:15:00 AM | Sediment |
| 50431 | SEDBACK1700N | 6/12/2017 12:00:00 PM | Sediment |
| 50432 | SEDBACK1800N | 6/12/2017 1:15:00 PM | Sediment |
| 50433 | SEDBACK1900N | 6/13/2017 8:00:00 AM | Sediment |
| 50434 | SEDBACK2000N | 6/13/2017 9:45:00 AM | Sediment |

Submitted By:

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**Project:** Pepco Benning Road Facility

## TOXICITY DETAIL REPORT:

**100.1** Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

Sample ID: 50413 CONTROL

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 23.99 | 25.16 | ***0.13*** |
| B | 10 | 10 | ***100.0%*** | 10 | 22.98 | 24.54 | ***0.16*** |
| C | 10 | 10 | ***100.0%*** | 10 | 26.05 | 27.59 | ***0.15*** |
| D | 10 | 8 | ***80.0%*** | 8 | 22.98 | 24.58 | ***0.20*** |
| E | 10 | 10 | ***100.0%*** | 10 | 24.66 | 26.10 | ***0.14*** |
| F | 10 | 10 | ***100.0%*** | 10 | 23.83 | 25.65 | ***0.18*** |
| G | 10 | 9 | ***90.0%*** | 9 | 23.93 | 25.54 | ***0.18*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.85 | 25.32 | ***0.15*** |

Mean Percent Surviving (%): 95.0 Mean Growth Weight (mg): 0.161

Sample ID: 50415 SED6C00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 22.02 | 23.34 | ***0.15*** |
| B | 10 | 10 | ***100.0%*** | 10 | 24.26 | 26.10 | ***0.18*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.65 | 25.07 | ***0.14*** |
| D | 10 | 10 | ***100.0%*** | 10 | 24.48 | 25.77 | ***0.13*** |
| E | 10 | 9 | ***90.0%*** | 9 | 22.52 | 23.64 | ***0.12*** |
| F | 10 | 10 | ***100.0%*** | 10 | 23.16 | 24.40 | ***0.12*** |
| G | 10 | 9 | ***90.0%*** | 9 | 25.35 | 26.58 | ***0.14*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.61 | 25.06 | ***0.14*** |

Mean Percent Surviving (%): 96.3 Mean Growth Weight (mg): 0.141

# TOXICITY DETAIL REPORT:

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

### Sample ID: 50416 SED8C00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 22.91 | 24.40 | ***0.15*** |
| B | 10 | 9 | ***90.0%*** | 9 | 23.74 | 24.87 | ***0.13*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.66 | 24.82 | ***0.12*** |
| D | 10 | 10 | ***100.0%*** | 10 | 23.03 | 24.62 | ***0.16*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.89 | 25.24 | ***0.14*** |
| F | 10 | 9 | ***90.0%*** | 9 | 21.88 | 23.17 | ***0.14*** |
| G | 10 | 10 | ***100.0%*** | 10 | 24.03 | 25.30 | ***0.13*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.50 | 25.07 | ***0.16*** |

Mean Percent Surviving (%): 97.5 Mean Growth Weight (mg): 0.139

### Sample ID: 50417 SED7B00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 25.09 | 26.02 | ***0.09*** |
| B | 10 | 10 | ***100.0%*** | 10 | 23.80 | 25.21 | ***0.14*** |
| C | 10 | 8 | ***80.0%*** | 8 | 23.81 | 24.97 | ***0.14*** |
| D | 10 | 9 | ***90.0%*** | 9 | 23.00 | 24.18 | ***0.13*** |
| E | 10 | 9 | ***90.0%*** | 9 | 24.24 | 25.62 | ***0.15*** |
| F | 10 | 9 | ***90.0%*** | 9 | 23.60 | 24.68 | ***0.12*** |
| G | 10 | 8 | ***80.0%*** | 8 | 23.56 | 24.49 | ***0.12*** |
| H | 10 | 9 | ***90.0%*** | 9 | 24.29 | 25.33 | ***0.12*** |

Mean Percent Surviving (%): 90.0 Mean Growth Weight (mg): 0.127

### Sample ID: 50418 SED7F00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 24.15 | 25.27 | ***0.11*** |
| B | 10 | 8 | ***80.0%*** | 8 | 22.51 | 23.73 | ***0.15*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.01 | 24.42 | ***0.14*** |
| D | 10 | 10 | ***100.0%*** | 10 | 22.91 | 24.40 | ***0.15*** |
| E | 10 | 10 | ***100.0%*** | 10 | 22.85 | 24.40 | ***0.15*** |
| F | 10 | 10 | ***100.0%*** | 10 | 23.70 | 25.19 | ***0.15*** |
| G | 10 | 10 | ***100.0%*** | 10 | 25.47 | 26.56 | ***0.11*** |
| H | 10 | 9 | ***90.0%*** | 9 | 23.68 | 25.08 | ***0.16*** |

Mean Percent Surviving (%): 96.3 Mean Growth Weight (mg): 0.140

# TOXICITY DETAIL REPORT:

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

Sample ID: 50419 SED7.5E00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 23.47 | 24.88 | ***0.14*** |
| B | 10 | 10 | ***100.0%*** | 10 | 23.02 | 24.25 | ***0.12*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.56 | 24.80 | ***0.12*** |
| D | 10 | 10 | ***100.0%*** | 10 | 21.91 | 23.27 | ***0.14*** |
| E | 10 | 10 | ***100.0%*** | 9 | 23.20 | 24.23 | ***0.11*** |
| F | 10 | 10 | ***100.0%*** | 10 | 23.39 | 24.88 | ***0.15*** |
| G | 10 | 9 | ***90.0%*** | 9 | 23.63 | 24.97 | ***0.15*** |
| H | 10 | 10 | ***100.0%*** | 10 | 22.50 | 24.04 | ***0.15*** |

Mean Percent Surviving (%): 98.8 Mean Growth Weight (mg): 0.136

Sample ID: 50420 SED6.5E00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 22.72 | 24.29 | ***0.17*** |
| B | 10 | 9 | ***90.0%*** | 9 | 23.78 | 24.81 | ***0.11*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.90 | 25.35 | ***0.15*** |
| D | 10 | 10 | ***100.0%*** | 10 | 22.45 | 23.78 | ***0.13*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.14 | 24.63 | ***0.15*** |
| F | 10 | 10 | ***100.0%*** | 10 | 24.51 | 26.24 | ***0.17*** |
| G | 10 | 9 | ***90.0%*** | 9 | 21.68 | 22.90 | ***0.14*** |
| H | 11 | 11 | ***100.0%*** | 11 | 26.21 | 27.94 | ***0.16*** |

Mean Percent Surviving (%): 96.3 Mean Growth Weight (mg): 0.148

Sample ID: 50421 SED7E00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 22.71 | 23.94 | ***0.12*** |
| B | 10 | 10 | ***100.0%*** | 10 | 22.97 | 24.16 | ***0.12*** |
| C | 10 | 8 | ***80.0%*** | 8 | 22.58 | 23.59 | ***0.13*** |
| D | 10 | 7 | ***70.0%*** | 7 | 24.81 | 26.01 | ***0.17*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.50 | 24.91 | ***0.14*** |
| F | 10 | 10 | ***100.0%*** | 10 | 22.97 | 24.23 | ***0.13*** |
| G | 10 | 10 | ***100.0%*** | 10 | 24.43 | 25.57 | ***0.11*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.79 | 25.11 | ***0.13*** |

Mean Percent Surviving (%): 93.8 Mean Growth Weight (mg): 0.132

# TOXICITY DETAIL REPORT:

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

Sample ID: 50422 SED6B00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 22.20 | 23.17 | ***0.11*** |
| B | 10 | 10 | ***100.0%*** | 10 | 24.25 | 25.72 | ***0.15*** |
| C | 10 | 7 | ***70.0%*** | 7 | 23.05 | 24.59 | ***0.22*** |
| D | 10 | 10 | ***100.0%*** | 10 | 22.82 | 24.10 | ***0.13*** |
| E | 10 | 10 | ***100.0%*** | 10 | 24.80 | 26.46 | ***0.17*** |
| F | 10 | 9 | ***90.0%*** | 9 | 23.55 | 24.75 | ***0.13*** |
| G | 10 | 10 | ***100.0%*** | 10 | 22.83 | 24.48 | ***0.16*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.48 | 24.69 | ***0.12*** |

Mean Percent Surviving (%): 93.8 Mean Growth Weight (mg): 0.149

Sample ID: 50423 SED6A00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 8 | 22.67 | 23.64 | ***0.12*** |
| B | 10 | 9 | ***90.0%*** | 9 | 24.19 | 25.33 | ***0.13*** |
| C | 11 | 11 | ***100.0%*** | 11 | 23.47 | 24.46 | ***0.09*** |
| D | 10 | 9 | ***90.0%*** | 9 | 23.76 | 25.27 | ***0.17*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.91 | 25.38 | ***0.15*** |
| F | 10 | 10 | ***100.0%*** | 10 | 21.63 | 22.79 | ***0.12*** |
| G | 10 | 9 | ***90.0%*** | 9 | 22.44 | 23.80 | ***0.15*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.28 | 24.53 | ***0.13*** |

Mean Percent Surviving (%): 95.0 Mean Growth Weight (mg): 0.131

Sample ID: 50424 SED7.5D00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 21.90 | 23.04 | ***0.13*** |
| B | 10 | 10 | ***100.0%*** | 10 | 22.04 | 23.67 | ***0.16*** |
| C | 10 | 10 | ***100.0%*** | 10 | 22.24 | 23.34 | ***0.11*** |
| D | 10 | 10 | ***100.0%*** | 10 | 23.12 | 24.56 | ***0.14*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.27 | 24.84 | ***0.16*** |
| F | 10 | 9 | ***90.0%*** | 9 | 22.86 | 23.87 | ***0.11*** |
| G | 10 | 10 | ***100.0%*** | 10 | 23.19 | 24.69 | ***0.15*** |
| H | 10 | 9 | ***90.0%*** | 9 | 22.88 | 24.05 | ***0.13*** |

Mean Percent Surviving (%): 96.3 Mean Growth Weight (mg): 0.137

## TOXICITY DETAIL REPORT:

### 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

Sample ID: 50425 SED7D00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 8 | ***80.0%*** | 8 | 23.17 | 24.50 | ***0.17*** |
| B | 10 | 10 | ***100.0%*** | 10 | 21.76 | 23.31 | ***0.15*** |
| C | 10 | 10 | ***100.0%*** | 10 | 22.73 | 24.12 | ***0.14*** |
| D | 10 | 10 | ***100.0%*** | 10 | 21.63 | 23.22 | ***0.16*** |
| E | 10 | 10 | ***100.0%*** | 10 | 24.63 | 25.86 | ***0.12*** |
| F | 10 | 9 | ***90.0%*** | 9 | 22.91 | 23.13 | ***0.02*** |
| G | 10 | 9 | ***90.0%*** | 9 | 23.97 | 25.38 | ***0.16*** |
| H | 10 | 9 | ***90.0%*** | 9 | 24.40 | 26.90 | ***0.28*** |

Mean Percent Surviving (%): 93.8 Mean Growth Weight (mg): 0.150

Sample ID: 50426 SED6.5D00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 23.93 | 25.12 | ***0.13*** |
| B | 10 | 9 | ***90.0%*** | 9 | 23.47 | 24.84 | ***0.15*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.82 | 25.04 | ***0.12*** |
| D | 10 | 9 | ***90.0%*** | 9 | 24.56 | 25.87 | ***0.15*** |
| E | 10 | 9 | ***90.0%*** | 9 | 22.39 | 23.83 | ***0.16*** |
| F | 10 | 10 | ***100.0%*** | 10 | 23.15 | 24.80 | ***0.16*** |
| G | 10 | 10 | ***100.0%*** | 10 | 22.93 | 24.74 | ***0.18*** |
| H | 10 | 10 | ***100.0%*** | 10 | 22.43 | 23.83 | ***0.14*** |

Mean Percent Surviving (%): 95.0 Mean Growth Weight (mg): 0.150

Sample ID: 50427 SED8A00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 23.55 | 24.83 | ***0.13*** |
| B | 10 | 10 | ***100.0%*** | 10 | 23.87 | 25.06 | ***0.12*** |
| C | 10 | 10 | ***100.0%*** | 10 | 21.70 | 23.27 | ***0.16*** |
| D | 10 | 10 | ***100.0%*** | 10 | 23.28 | 24.39 | ***0.11*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.30 | 24.48 | ***0.12*** |
| F | 10 | 10 | ***100.0%*** | 10 | 22.72 | 24.11 | ***0.14*** |
| G | 10 | 9 | ***90.0%*** | 9 | 23.69 | 25.14 | ***0.16*** |
| H | 10 | 10 | ***100.0%*** | 10 | 22.94 | 24.12 | ***0.12*** |

Mean Percent Surviving (%): 98.8 Mean Growth Weight (mg): 0.131

# TOXICITY DETAIL REPORT:

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

Sample ID: 50428 SED7A00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 9 | 23.79 | 24.98 | ***0.13*** |
| B | 10 | 10 | ***100.0%*** | 10 | 24.21 | 26.10 | ***0.19*** |
| C | 10 | 10 | ***100.0%*** | 9 | 23.52 | 24.77 | ***0.14*** |
| D | 10 | 9 | ***90.0%*** | 9 | 22.42 | 23.63 | ***0.13*** |
| E | 10 | 9 | ***90.0%*** | 9 | 23.59 | 24.89 | ***0.14*** |
| F | 10 | 10 | ***100.0%*** | 9 | 23.64 | 25.09 | ***0.16*** |
| G | 10 | 10 | ***100.0%*** | 10 | 21.59 | 23.04 | ***0.15*** |
| H | 10 | 7 | ***70.0%*** | 7 | 24.66 | 25.46 | ***0.11*** |

Mean Percent Surviving (%): 93.8 Mean Growth Weight (mg): 0.145

Sample ID: 50429 SED8B00EN

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 22.31 | 23.63 | ***0.13*** |
| B | 10 | 10 | ***100.0%*** | 10 | 27.73 | 29.23 | ***0.15*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.43 | 25.02 | ***0.16*** |
| D | 10 | 9 | ***90.0%*** | 8 | 23.68 | 24.91 | ***0.15*** |
| E | 10 | 9 | ***90.0%*** | 9 | 23.82 | 25.29 | ***0.16*** |
| F | 10 | 9 | ***90.0%*** | 9 | 24.11 | 25.27 | ***0.13*** |
| G | 10 | 10 | ***100.0%*** | 10 | 21.80 | 22.75 | ***0.10*** |
| H | 10 | 10 | ***100.0%*** | 10 | 22.72 | 24.32 | ***0.16*** |

Mean Percent Surviving (%): 96.3 Mean Growth Weight (mg): 0.143

Sample ID: 50430 SEDBACK1600N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 24.06 | 25.09 | ***0.11*** |
| B | 10 | 6 | ***60.0%*** | 6 | 22.90 | 23.64 | ***0.12*** |
| C | 10 | 9 | ***90.0%*** | 9 | 22.85 | 23.94 | ***0.12*** |
| D | 10 | 8 | ***80.0%*** | 8 | 23.33 | 24.48 | ***0.14*** |
| E | 10 | 9 | ***90.0%*** | 9 | 22.83 | 23.59 | ***0.08*** |
| F | 10 | 9 | ***90.0%*** | 9 | 22.92 | 23.77 | ***0.09*** |
| G | 10 | 7 | ***70.0%*** | 7 | 24.10 | 24.97 | ***0.12*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.73 | 24.85 | ***0.11*** |

Mean Percent Surviving (%): 83.8 Mean Growth Weight (mg): 0.115

# TOXICITY DETAIL REPORT:

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

Sample ID: 50431 SEDBACK1700N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 23.62 | 24.79 | ***0.13*** |
| B | 10 | 10 | ***100.0%*** | 10 | 26.59 | 28.14 | ***0.15*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.56 | 24.86 | ***0.13*** |
| D | 10 | 10 | ***100.0%*** | 10 | 24.27 | 25.87 | ***0.16*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.76 | 25.16 | ***0.14*** |
| F | 10 | 10 | ***100.0%*** | 10 | 23.75 | 25.59 | ***0.18*** |
| G | 10 | 10 | ***100.0%*** | 10 | 24.44 | 26.32 | ***0.19*** |
| H | 10 | 8 | ***80.0%*** | 8 | 25.30 | 26.21 | ***0.11*** |

Mean Percent Surviving (%): 96.3 Mean Growth Weight (mg): 0.150

Sample ID: 50432 SEDBACK1800N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 9 | 22.94 | 24.24 | ***0.14*** |
| B | 10 | 9 | ***90.0%*** | 9 | 25.24 | 26.74 | ***0.17*** |
| C | 10 | 10 | ***100.0%*** | 10 | 23.91 | 25.49 | ***0.16*** |
| D | 10 | 10 | ***100.0%*** | 10 | 22.39 | 23.65 | ***0.13*** |
| E | 10 | 10 | ***100.0%*** | 9 | 23.80 | 24.84 | ***0.12*** |
| F | 10 | 10 | ***100.0%*** | 10 | 23.07 | 24.77 | ***0.17*** |
| G | 10 | 10 | ***100.0%*** | 10 | 22.65 | 23.99 | ***0.13*** |
| H | 11 | 11 | ***100.0%*** | 11 | 23.14 | 24.81 | ***0.15*** |

Mean Percent Surviving (%): 97.5 Mean Growth Weight (mg): 0.146

Sample ID: 50433 SEDBACK1900N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 10 | ***100.0%*** | 10 | 23.75 | 25.29 | ***0.15*** |
| B | 10 | 10 | ***100.0%*** | 10 | 22.76 | 24.37 | ***0.16*** |
| C | 10 | 10 | ***100.0%*** | 10 | 22.68 | 24.29 | ***0.16*** |
| D | 10 | 9 | ***90.0%*** | 9 | 22.48 | 23.34 | ***0.10*** |
| E | 10 | 10 | ***100.0%*** | 10 | 23.77 | 25.10 | ***0.13*** |
| F | 10 | 9 | ***90.0%*** | 9 | 23.92 | 25.09 | ***0.13*** |
| G | 10 | 10 | ***100.0%*** | 10 | 24.08 | 25.68 | ***0.16*** |
| H | 10 | 10 | ***100.0%*** | 10 | 23.59 | 25.10 | ***0.15*** |

Mean Percent Surviving (%): 97.5 Mean Growth Weight (mg): 0.143

# TOXICITY DETAIL REPORT:

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

***Test Start:*** *7/28/2017 2:40:00 PM* ***Test End:*** *8/7/2017 4:30:00 PM*

Sample ID: 50434 SEDBACK2000N

| Rep. | Start Count | Total Surviving | Percent Surviving | # Weighed | Initial (mg) | Final (mg) | Mean Weight |
|---|---|---|---|---|---|---|---|
| A | 10 | 9 | ***90.0%*** | 8 | 22.71 | 23.85 | ***0.14*** |
| B | 10 | 9 | ***90.0%*** | 9 | 22.73 | 24.17 | ***0.16*** |
| C | 10 | 9 | ***90.0%*** | 9 | 22.92 | 24.23 | ***0.15*** |
| D | 10 | 9 | ***90.0%*** | 9 | 21.80 | 23.29 | ***0.17*** |
| E | 10 | 8 | ***80.0%*** | 8 | 23.86 | 25.28 | ***0.18*** |
| F | 10 | 9 | ***90.0%*** | 9 | 23.65 | 24.90 | ***0.14*** |
| G | 10 | 10 | ***100.0%*** | 10 | 23.47 | 24.96 | ***0.15*** |
| H | 10 | 10 | ***100.0%*** | 10 | 22.90 | 24.40 | ***0.15*** |

Mean Percent Surviving (%): 91.3 Mean Growth Weight (mg): 0.154

Submitted By:

# Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

AECOM
250 Apollo Drive

Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com

**Project:** Pepco Benning Road Facility

## Narrative

Twenty project sediment samples in 1-gal HDPE buckets were delivered to Aquatec Environmental, Inc. (Aquatec) on June 15, 2017. All samples were in coolers, with samples well iced. Samples were logged in for "Hold" pending approval to proceed with testing. Each sample was assigned a unique sample number and transferred to refrigerated storage.

On July 20, 2017 AECOM communicated that twenty of the samples would be tested and provided authorization to proceed. The selected samples were logged in for EPA Method 100.1 (Hyalella azteca 10-day survival and growth) and EPA Method 100.2 (Chironomus dilutus 10-day survival and growth).

Control sediment was a mix of natural sediment collected from the Lamoille River, Vermont and Lake Arrowhead, Vermont on June 19, 2017. Control sediment was sieved through a 0.5mm SS mesh sieve in the field at the time of collection.

Un-sieved sediment for each sample was loaded into test beakers on July 27, 2017 for the Hyalella azteca 10-day test and on July 31, 2017 for the Chironomus dilutus 10-day test. Overlying water was introduced following distribution of sediments to beakers and replicates were distributed to temperature-controlled water baths with automated overlying water renewals programmed at 12h intervals.

Statistical analysis of survival and growth was based on paired t-test comparisons to the corresponding response in the control (sample 50413) and to the five reference samples identified by AECOM: Aquatec sample numbers 50430 (SEDBACK1600N), 50431 (SEDBACK1700N), 50432 (SEDBACK1800N), 50433 (SEDBACK1900N), and 50434 (SEDBACK2000N).

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**Project:** Pepco Benning Road Facility

# 100.1 - Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments Qualifiers

The Hyalella azteca 10-day tests were started on July 28, 2017 when ten amphipods were allocated to each replicate.

Cart 1 of the test array did not receive a scheduled overlying water renewal for the midnight automatic renewal on July 28, 2017 (Day 1) because the water delivery ports had not been properly aligned with the test beakers. This was rectified by repositioning the delivery system and providing a renewal at approximately 9 a.m. on the following morning.

Aeration of test replicates was not required because measurements of subsamples of overlying water and measurements directly in test beakers indicated dissolved oxygen concentrations were above the minimum acceptable level of 2.5mg/L specified in the EPA protocol.

The exposure period was completed on August 7, 2017 (Day 10) when tests were ended. Control sediment average survival was 95.8% which was above the minimum acceptable survival specified in the EPA protocol.

Amphipods were recovered by pipetting visible amphipods from a replicate and then sieving the sediment through a 0.5mm sieve to recover the remaining amphipods. Surviving amphipods were held in 1oz cups with overlying water until all project replicates were completed. They were then sacrificed by addition of 70% ethyl alcohol, transferred to a petri dish containing a deionized water rinse, and then transferred to labeled and pre-weighed aluminum pans. If discrepancies in amphipod counts occurred, the number of amphipods recorded as surviving was used as the surviving number and the number recorded as weighed was used as the number weighed (i.e, data were tabulated as recorded). Eleven rather than ten amphipods were recovered from three test replicates. Apparently one extra amphipod was distributed to these three beakers. Data were used as recorded, with a starting number of eleven amphipods. Amphipods on pans were dried in a drying oven overnight to constant weight at approximately 80C. Pans with amphipods were then weighed to 0.02mg on a Mettler M3 microbalance. Amphipod growth assessment was based average dry weight (average dry weight of the surviving amphipods).

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**Project:** Pepco Benning Road Facility

## REPORT CERTIFICATION:

*The results reported relate only to the the samples submitted as received.*

I certify under penalty of law that this document and all ATTACHMENTs were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: September 13, 2017
*(Date)*

*(Authorized signature)*

John Williams
Director
Aquatec Environmental, Inc.

Chain-Of-Custody(s)

# Chain of Custody Record

Aquatec

AECOM
8000 Virginia Manor Road, Suite 110, Beltsville, MD
20705
(301) 289-3900 Phone (301) 289-3901 Fax

AECOM

Page 1 of 2

| | |
|---|---|
| Project Name: PEPCO Benning Rd- Waterside Investigation | Project Location: PEPCO Benning Road |
| Project Number: 60340344 | Project #: 60340344 |
| Sampler (print name) (Affiliation): Daniel Hubert AECOM | Chain of Custody Tape No. |
| Signature: [signature] | Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.com; TAT: Standard |

Analysis Required

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SED6C00EN | 6/7/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | |
| SED8C00EN | 6/7/17 | 1130 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7B00EN | 6/7/17 | 1230 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7F00EN | 6/8/17 | 0830 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7.5E00EN | 6/8/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6.5E00EN | 6/8/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7E00EN | 6/8/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6B00EN | 6/8/17 | 1230 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6A00EN | 6/8/17 | 1315 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7.5D00EN | 6/9/17 | 0815 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7D00EN | 6/9/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | |
| SED6.5D00EN | 6/9/17 | 0945 | | X | 1-gal | Sed | — | 1 | H | | |
| SED8A00EN | 6/9/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | |
| SED7A00EN | 6/9/17 | 1115 | | X | 1-gal | Sed | — | 1 | H | | |
| SED8B00EN | 6/9/17 | 1200 | | X | 1-gal | Sed | — | 1 | H | | |

| Reliquished By (Print Name) | Date/Time | Received By (Print Name) | Date/Time |
|---|---|---|---|
| Daniel Hubert; Signature: [signature] | Date: ; Time: | Matt Emery; Signature: [signature] | Date: 6/9/17; Time: 1435 |
| Reliquished By (Print Name): ; Signature: | Date: 6/15/17; Time: 10:40 | Kendra Nash; Signature: [signature] | Date: 6/15/17; Time: 16:35 |
| Reliquished By (Print Name): ; Signature: | Date: ; Time: | Received By (Print Name): ; Signature: | Date: ; Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

Samples received in coolers - well iced.

# Chain of Custody Record

Aquatec

AECOM
8000 Virginia Manor Road, Suite 110, Beltsville, MD
20705
(301) 289-3900 Phone (301) 289-3901 Fax

AECOM

Page 2 of 2

| | |
|---|---|
| Project Name: PEPCO Benning Rd- Waterside Investigation | Project Location: PEPCO Benning Road |
| Project Number: 60340344 | Project #: 60340344 |
| Sampler (print name) (Affiliation) Daniel Hulbert AECOM | Chain of Custody Tape No. |
| Signature | Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.cor — TAT: Standard |

Analysis Required

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SEDBACK1600N | 6/12/17 | 1015 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK1700N | 6/12/17 | 1206 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK1800N | 6/12/17 | 1315 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK1900N | 6/13/17 | 0800 | | X | 1-gal | Sed | — | 1 | X | | |
| SEDBACK2000N | 6/13/17 | 0945 | | X | 1-gal | Sed | — | 1 | X | | |

| Reliquished By (Print Name) | Date / Time | Received By (Print Name) | Date / Time |
|---|---|---|---|
| Daniel Hulbert; Signature: [signature] | Date: 6/13/17; Time: | Received By: ; Signature: | Date: ; Time: |
| Reliquished By: ; Signature: | Date: 6/15/17; Time: 10:40 | Received By: Kendra Nash; Signature: [signature] | Date: 6/15/17; Time: 16:35 |
| Reliquished By: ; Signature: | Date: ; Time: | Received By: ; Signature: | Date: ; Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

Samples received in coolers - well iced

AECOM/KENNEDY

17022

(COPY)

# Chain of Custody Record

Aquatec

**AECOM**
8000 Virginia Manor Road, Suite 110, Beltsville, MD
20705
(301) 289-3900 Phone (301) 289-3901 Fax

**AECOM**

| | |
|---|---|
| Project Name: PEPCO Benning Rd- Waterside Investigation | Project Location: PEPCO Benning Road |
| Project Number: 60340344 | Project #: 60340344 |
| Sampler (print name) (Affiliation) Daniel Hulbert AECOM | Chain of Custody Tape No. |
| Signature [signature] | Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.com — TAT: Standard |

Analysis Required — Page 1 of 2

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | ① Remarks Cooler temperatures °C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SED6C00EN | 6/7/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | 1.4 |
| SED8C00EN | 6/7/17 | 1130 | | X | 1-gal | Sed | — | 1 | H | | 1.4 |
| SED7B00EN | 6/8/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | 1.4 |
| SED7F00EN | 6/8/17 | 0830 | | X | 1-gal | Sed | — | 1 | H | | 1.3 |
| SED7.5E00EN | 6/8/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED6.5E00EN | 6/8/17 | 1000 | | X | 1-gal | Sed | — | 1 | H | | 1.3 |
| SED7E00EN | 6/8/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | 1.3 |
| SED6B00EN | 6/8/17 | 1230 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED6A00EN | 6/8/17 | 1315 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED7.5D00EN | 6/9/17 | 0815 | | X | 1-gal | Sed | — | 1 | H | | ~~1.2~~ 1.4 |
| SED7D00EN | 6/9/17 | 0915 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED6.5D00EN | 6/9/17 | 0945 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED8A00EN | 6/9/17 | 1030 | | X | 1-gal | Sed | — | 1 | H | | 1.2 |
| SED7A00EN | 6/9/17 | 1115 | | X | 1-gal | Sed | — | 1 | H | | 1.1 |
| SED8B00EN | 6/9/17 | 1200 | | X | 1-gal | Sed | — | 1 | H | | 1.1 |

(Temp Blank) 6/15/17

| Relinquished By (Print Name) | Date/Time | Received By (Print Name) | Date/Time |
|---|---|---|---|
| Daniel Hulbert / Signature: [signature] | Date: / Time: | Matt Emery / Signature: [signature] | Date: 6/9/17 / Time: 1435 |
| Relinquished By (Print Name) / Signature: | Date: / Time: | Received By (Print Name) / Signature: | Date: / Time: |
| Relinquished By (Print Name) / Signature: | Date: / Time: | Received By (Print Name) / Signature: | Date: / Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

① Record of temperatures for samples as received (temperature blanks) 6/15/17

# Chain of Custody Record

Aquatec

COPY

AECOM
8000 Virginia Manor Road, Suite 110, Beltsville, MD
20705
(301) 289-3900 Phone (301) 289-3901 Fax

AECOM

| | | |
|---|---|---|
| Project Name: PEPCO Benning Rd- Waterside Investigation | Project Location: PEPCO Benning Road | Page 2 of 2 |
| Project Number: 60340344 | Project #: 60340344 | |
| Sampler (print name) (Affiliation) Daniel Hulbert AECOM | Chain of Custody Tape No. | |
| Signature [signature] | Send Result/Report to: Robert Kennedy, Robert.Kennedy@aecom.cor; TAT: Standard | |

Analysis Required

| Field Sample No/ Identification | Date | Sample Time | COMP | GRAB | Sample Container | Matrix | Preserv. | Total # of Containers | Lab Toxicity | Lab ID | (1) Remarks Cooler Temperatures °C (Temp Blanks) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SEDBACK1600N | 6/12/17 | 1015 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK1700N | 6/12/17 | 1200 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK1800N | 6/12/17 | 1315 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK1900N | 6/13/17 | 0800 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |
| SEDBACK2000N | 6/13/17 | 0945 | | X | 1-gal | Sed | — | 1 | X | | 1.4 |

6/15/17

| | | | |
|---|---|---|---|
| Relinquished By (Print Name) Daniel Hulbert; Signature: [signature] | Date: 6/13/17; Time: | Received By (Print Name); Signature: | Date:; Time: |
| Relinquished By (Print Name); Signature: | Date:; Time: | Received By (Print Name); Signature: | Date:; Time: |
| Relinquished By (Print Name); Signature: | Date:; Time: | Received By (Print Name); Signature: | Date:; Time: |

Additional Comments:

**Aquatec- Background and Near Site Surface Sediment Sampling**

Background Locations- Analyze "X"
Near-Site Locations- Hold "H"

(1) Record of temperature blanks for samples as received (temperature blanks)
6/15/17

10:40

Page: ____ of ____

# Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

| COMPANY INFORMATION | PROJECT INFORMATION |
|---|---|
| NAME: | PROJECT: |
| ADDRESS: | |
| | PROJECT #: |
| TEL: | SAMPLERS NAME(S): |
| CONTACT: | |
| E-MAIL: | PERMIT NUMBER: |

VOLUME/CONTAINER TYPE/ PRESERVATIVE: Gallons, HDPE Bucket

| SAMPLE IDENTIFICATION | COLLECTION DATE | COLLECTION TIME | GRAB | COMPOSITE | MATRIX | NUMBER OF CONTAINERS (Gallons, HDPE Bucket) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lamoille River (sandy) | 6/19/17 | 08:00 | X | | SED | 2-3 | | | | | | | |
| Lake Arrowhead (soft mud) | 6/19/17 | 08:30 | X | | SED | 2-3 | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

ANALYSIS (TEST/DETECTION LIMITS) –

| RELINQUISHED BY: (Signature) | DATE: | TIME: | RECEIVED BY: (Signature) | TEMPERATURE ON DELIVERY (°C): |
|---|---|---|---|---|
| | 6/19/17 | 09:30 | | NOTES: |
| RELINQUISHED BY: (Signature) | DATE: | TIME: | RECEIVED BY: (Signature) | Sediments sieved (0.5 mm) in field. Blended as Control sediment |
| RELINQUISHED BY: (Signature) | DATE: | TIME: | RECEIVED BY: (Signature) | |

**SAMPLE ACCEPTANCE POLICY AND RECOMMENDATIONS:**

1) Proper, full, and complete documentation on the Chain-of-Custody (sample ID, location, date and time of collection, sampler's name, preservation type, sample type (matrix) and any special remarks concerning the sample);
2) Proper and legible sample labeling with initials, date and time and use of appropriate containers;
3) Provide adequate sample volume and apply tape around caps to prevent dislodgement during shipping;
4) Ship samples with sufficient ice to maintain acceptable shipping temperature range of 0-6°C;
5) Samples should be received within specified holding times based on controlling regulations

***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report***

# Aquatec Environmental, Inc.

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Tel: (802) 860 - 2960



AECOM
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Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com


**Client ID:** AECOM/Kennedy

## ALKALINITY AND HARDNESS REPORT:

**100.1** Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

Day 0

| Sample ID: | Analysis Date: | Alkalinity: (mg/L) | Hardness: (mg/L) |
|---|---|---|---|
| 50413 - CONTROL | 7/28/2017 | 88.0 | 104.0 |
| 50415 - SED6C00EN | 7/28/2017 | 104.0 | 104.0 |
| 50416 - SED8C00EN | 7/28/2017 | 96.0 | 108.0 |
| 50417 - SED7B00EN | 7/28/2017 | 104.0 | 108.0 |
| 50418 - SED7F00EN | 7/28/2017 | 96.0 | 116.0 |
| 50419 - SED7.5E00EN | 7/28/2017 | 92.0 | 112.0 |
| 50420 - SED6.5E00EN | 7/28/2017 | 112.0 | 136.0 |
| 50421 - SED7E00EN | 7/28/2017 | 96.0 | 120.0 |
| 50422 - SED6B00EN | 7/28/2017 | 124.0 | 124.0 |
| 50423 - SED6A00EN | 7/28/2017 | 136.0 | 112.0 |
| 50424 - SED7.5D00EN | 7/28/2017 | 84.0 | 96.0 |
| 50425 - SED7D00EN | 7/28/2017 | 92.0 | 112.0 |
| 50426 - SED6.5D00EN | 7/28/2017 | 116.0 | 120.0 |
| 50427 - SED8A00EN | 7/28/2017 | 108.0 | 128.0 |
| 50428 - SED7A00EN | 7/28/2017 | 124.0 | 112.0 |
| 50429 - SED8B00EN | 7/28/2017 | 120.0 | 112.0 |
| 50430 - SEDBACK1600N | 7/28/2017 | 124.0 | 124.0 |
| 50431 - SEDBACK1700N | 7/28/2017 | 108.0 | 152.0 |
| 50432 - SEDBACK1800N | 7/28/2017 | 120.0 | 132.0 |
| 50433 - SEDBACK1900N | 7/28/2017 | 116.0 | 140.0 |
| 50434 - SEDBACK2000N | 7/28/2017 | 144.0 | 152.0 |

*INF: Interference. The color endpoint was reached immediatel*



Reviewed by: GW Date: 9/11/17

**SDG:** 15151
**Project** 17022

# Aquatec Environmental, Inc.

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Williston, VT 05495
Tel: (802) 860 - 2960



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Chelmsford, MA 01824

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**E-Mail:** robert.kennedy@aecom.com


**Client ID:** AECOM/Kennedy

## ALKALINITY AND HARDNESS REPORT:

**100.1** Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments
Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

Day 9

| Sample ID: | Analysis Date: | Alkalinity: (mg/L) | Hardness: (mg/L) |
|---|---|---|---|
| 50413 - CONTROL | 8/6/2017 | 76.0 | 96.0 |
| 50415 - SED6C00EN | 8/6/2017 | 72.0 | 96.0 |
| 50416 - SED8C00EN | 8/6/2017 | 80.0 | 104.0 |
| 50417 - SED7B00EN | 8/6/2017 | 80.0 | 96.0 |
| 50418 - SED7F00EN | 8/6/2017 | 88.0 | 104.0 |
| 50419 - SED7.5E00EN | 8/6/2017 | 88.0 | 104.0 |
| 50420 - SED6.5E00EN | 8/6/2017 | 92.0 | 104.0 |
| 50421 - SED7E00EN | 8/6/2017 | 88.0 | 104.0 |
| 50422 - SED6B00EN | 8/6/2017 | 84.0 | 96.0 |
| 50423 - SED6A00EN | 8/6/2017 | 76.0 | 100.0 |
| 50424 - SED7.5D00EN | 8/6/2017 | 84.0 | 100.0 |
| 50425 - SED7D00EN | 8/6/2017 | 88.0 | 104.0 |
| 50426 - SED6.5D00EN | 8/6/2017 | 84.0 | 104.0 |
| 50427 - SED8A00EN | 8/6/2017 | 100.0 | 100.0 |
| 50428 - SED7A00EN | 8/6/2017 | 76.0 | 108.0 |
| 50429 - SED8B00EN | 8/6/2017 | 88.0 | 100.0 |
| 50430 - SEDBACK1600N | 8/6/2017 | 80.0 | 96.0 |
| 50431 - SEDBACK1700N | 8/6/2017 | 84.0 | 100.0 |
| 50432 - SEDBACK1800N | 8/6/2017 | 92.0 | 108.0 |
| 50433 - SEDBACK1900N | 8/6/2017 | 84.0 | 100.0 |
| 50434 - SEDBACK2000N | 8/6/2017 | 80.0 | 92.0 |

*INF: Interference. The color endpoint was reached immediatel*

# Aquatec Environmental, Inc.

273 Commerce Street
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## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Project:** Pepco Benning Road Facility

**AMMONIA ANALYSIS REPORT:**

| Sample: | Pore Water (mg/L) | Overlying Water (mg/L) | |
|---|---|---|---|
| | 7/28/2017 | 7/28/2017 | 8/6/2017 |
| 50413 / CONTROL | 26.3 | 0.8 | 1.4 |
| 50415 / SED6C00EN | 21.9 | 2.3 | 0.7 |
| 50416 / SED8C00EN | 40.9 | 0.1 BD | 0.8 |
| 50417 / SED7B00EN | 5.1 | 0.2 | 0.9 |
| 50418 / SED7F00EN | 17.3 | 2.2 | 0.9 |
| 50419 / SED7.5E00EN | 12.6 | 2.9 | 1.0 |
| 50420 / SED6.5E00EN | 20.3 | 1.6 | 1.2 |
| 50421 / SED7E00EN | 13.5 | 1.5 | 1.2 |
| 50422 / SED6B00EN | 9.2 | 1.8 | 1.0 |
| 50423 / SED6A00EN | 14.3 | 1.7 | 0.6 |
| 50424 / SED7.5D00EN | 9.8 | 2.7 | 0.6 |
| 50425 / SED7D00EN | 29.3 | 3.7 | 0.8 |
| 50426 / SED6.5D00EN | 31.8 | 1.5 | 0.9 |
| 50427 / SED8A00EN | 8.9 | 1.3 | 1.1 |
| 50428 / SED7A00EN | 17.2 | 1.7 | 1.9 |
| 50429 / SED8B00EN | 8.5 | 2.7 | 2.0 |
| 50430 / SEDBACK1600N | 17.9 | 3.4 | 1.7 |
| 50431 / SEDBACK1700N | 41.5 | 3.1 | 0.7 |
| 50432 / SEDBACK1800N | 35.7 | 3.8 | 0.8 |
| 50433 / SEDBACK1900N | 29.1 | 4.0 | 0.6 |
| 50434 / SEDBACK2000N | 27.4 | 2.8 | 0.9 |

*BD - Indicates a concentration value below the reporting limit (<0.1).*



Aquatec Environmental, Inc.
Reviewed by: AJ Date: 9/13/17

**SDG:** 15151
**Project** 17022

# Aquatec Environmental, Inc.

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Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com

**Client ID:** AECOM/Kennedy

## SEDIMENT CHARACTERIZATION:



| Sample # | Client Sample ID | Sediment Characteristics | Pore Water pH | Organisms Present | Initial/ Date |
|---|---|---|---|---|---|
| 50413 | CONTROL Sieved: Y / N 0.5mm Mesh size | Fine sand and silt | 7.0 | None seen | 7/27/17 |
| 50415 | SED6C00EN Sieved: Y / N N Mesh size | Fine, cohesive sediment. Some sticks, lumpy | 6.7 | Not seen | |
| 50416 | SED8C00EN Sieved: Y / N N Mesh size | Fine, cohesive sediment. Some sticks, lumpy | 6.8 | None seen | |
| 50417 | SED7B00EN Sieved: Y / N N Mesh size | Fine, cohesive Sediment. | 6.8 | Possible dead clam, small | |
| 50418 | SED7F00EN Sieved: Y / N N Mesh size | Fine, cohesive Sediment. Some sticks, leaves, lumpy | 6.7 | None seen | |
| 50419 | SED7.5E00EN Sieved: Y / N N Mesh size | Fine, cohesive Sediment, some sticks, leaves, lumpy | 6.6 | None seen | |
| 50420 | SED6.5E00EN Sieved: Y / N N Mesh size | Gritty sediment with stones, | 6.7 | None seen | |
| 50421 | SED7E00EN Sieved: Y / N N Mesh size | Fluid mud with rocks and sticks | 6.8 | None seen | |

Aquatec Environmental, Inc.
Reviewed by: OW Date: 9/9/17

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**Client ID:** AECOM/Kennedy

## SEDIMENT CHARACTERIZATION:



| Sample # | Client Sample ID | Sediment Characteristics | Pore Water pH | Organisms Present | Initial/ Date |
|---|---|---|---|---|---|
| 50422 | SED6B00EN<br>Sieved: Y / N N Mesh size | Soft mud and sand, lots of sticks and leaf litter | 6.7 | None seen | 7/27/17 |
| 50423 | SED6A00EN<br>Sieved: Y / N N Mesh size | Soft mud full of detritus light brown in Color | 6.6 | None seen | |
| 50424 | SED7.5D00EN<br>Sieved: Y / N N Mesh size | Milk chocolate Brown color Soft mud | 6.8 | None seen | |
| 50425 | SED7D00EN<br>Sieved: Y / N N Mesh size | Soft cohesive sediment with few sticks | 6.8 | None seen | |
| 50426 | ED6.5D00EN<br>Sieved: Y / N N Mesh size | loose soupy sediment with lots of sticks + Rocks | 6.6 | None seen | |
| 50427 | SED8A00EN<br>Sieved: Y / N N Mesh size | Soft cohesive sediment few sticks present | 6.8 | None seen | |
| 50428 | SED7A00EN<br>Sieved: Y / N N Mesh size | Fine cohesive sediment Some sticks | 6.7 | None seen | |
| 50429 | SED8B00EN<br>Sieved: Y / N N Mesh size | Soft mud & sand, grit Leaf litter | 6.7 | 1 large snail | |
| 50430 | SEDBACK1600N<br>Sieved: Y / N 2.8 mm Mesh size | mostly sticks, leaf litter, detritus | 6.6 | None seen | |

**Aquatec Environmental, Inc.**
Reviewed by: [initials] Date: 9/9/17

SDG: 15151
Project 17022

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**Client ID:** AECOM/Kennedy

## SEDIMENT CHARACTERIZATION:



| Sample # | Client Sample ID | Sediment Characteristics | Pore Water pH | Organisms Present | Initial/ Date |
|---|---|---|---|---|---|
| 50431 | SEDBACK1700N<br>Sieved: Y / N N Mesh size | loose fluid sediment with a lot of detritus | 6.5 | None Seen | |
| 50432 | SEDBACK1800N<br>Sieved: Y / N N Mesh size | gritty sediment full of Rocks and debris, fluid | 6.7 | None seen | |
| 50433 | SEDBACK1900N<br>Sieved: Y / N N Mesh size | Stones and gravel, some very fluid sediment. Allowing stones to settle ~~and pottin~~ before distributing fluid sediment to beakers. Some sticks and leaf litter | 6.9 | None seen | |
| 50434 | SEDBACK2000N<br>Sieved: Y / N N Mesh size | fluid sediment, lots of detritus | 6.6 | None seen | |

**Aquatec Environmental, Inc.**
Reviewed by: [illegible] Date: 9/9/17.



**SDG:** 15151
**Project** 17022

# Toxicity Test Method(s)

# 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Project:** Pepco Benning Road Facility

| | | |
|---|---|---|
| 1 | Test type: | Whole-sediment toxicity test with renewal of overlying water |
| 2 | Temperature: | 23 +/- 1C |
| 3 | Light quality: | Wide-spectrum fluorescent lights |
| 4 | Illuminance: | About 100 to 1000lux |
| 5 | Photoperiod: | 16L:8D |
| 6 | Test chamber: | 300 mL high-form lipless beaker |
| 7 | Sediment volume: | 100 mL |
| 8 | Overlying water volume: | 175 mL |
| 9 | Renewal of overlying water: | 2 volume additions/day (e.g. 1 volume addition every 12h) |
| 10 | Age of organisms: | 7 to 14 day old at the start of the test (1-2 day in range) |
| 11 | No. of organisms/chamber: | 10 |
| 12 | No. of replicate chambers/treatment: | 8 |
| 13 | Feeding: | YCT food, fed 1.0 mL daily (1800 mg/L stock) to each test chamber. |
| 14 | Aeration: | None, unless dissolved oxygen in overlying water drops below 2.5 mg/L |
| 15 | Overlying water: | Reconstituted water |
| 16 | Test chamber cleaning: | If screens become clogged during a test, gently brush the outside of the screen |
| 17 | Overlying water quality: | Hardness, alkalinity, conductivity, pH, and ammonia at the beginning and end of a test (e.g. Days 0 and 9 or 10). Temperature and dissolved oxygen daily. |
| 18 | Test duration: | 10 days |
| 19 | Endpoints: | Survival and growth (by dry weight) |
| 20 | Test acceptability: | Minimum mean control survival of 80% and measurable growth of test organisms in the control sediment. |

# 100.1 - Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

*Hyalella azteca*

10-day survival and

growth test (dry weight)

Statistical analysis of test data compared to

CONTROL

(Aquatec Sample # 50413)

STATISTICAL COMPARISONS TO CONTROL (50413)



**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 00-8077-4874 | **Test Type:** | Survival-Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 28 Jul-17 14:40 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 07 Aug-17 16:30 | **Species:** | Hyalella azteca | **Brine:** | |
| **Duration:** | 10d 2h | **Source:** | Aquatic Biosystems, CO | **Age:** | 12d |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 02-7197-7953 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0414 | 50415 failed mean dry weight-mg |
| 08-8756-8177 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0199 | 50416 failed mean dry weight-mg |
| 13-3859-9717 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0031 | 50417 failed mean dry weight-mg |
| 10-6572-0343 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0335 | 50418 failed mean dry weight-mg |
| 12-3701-8521 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0105 | 50419 failed mean dry weight-mg |
| 11-3639-5384 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1147 | 50420 passed mean dry weight-mg |
| 09-7798-3999 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0062 | 50421 failed mean dry weight-mg |
| 09-3826-5852 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2005 | 50422 passed mean dry weight-mg |
| 13-0087-5995 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0104 | 50423 failed mean dry weight-mg |
| 12-3264-0886 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0189 | 50424 failed mean dry weight-mg |
| 03-7022-9966 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.3332 | 50425 passed mean dry weight-mg |
| 20-7126-2216 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1438 | 50426 passed mean dry weight-mg |
| 05-1548-6413 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0067 | 50427 failed mean dry weight-mg |
| 15-3165-1915 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0838 | 50428 passed mean dry weight-mg |
| 12-2618-4782 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0644 | 50429 passed mean dry weight-mg |
| 19-8497-1087 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 2.7E-04 | 50430 failed mean dry weight-mg |
| 16-6777-6118 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1886 | 50431 passed mean dry weight-mg |
| 07-7639-2252 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0832 | 50432 passed mean dry weight-mg |
| 16-5672-6606 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0674 | 50433 passed mean dry weight-mg |
| 20-8072-9304 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2096 | 50434 passed mean dry weight-mg |
| 15-7429-8283 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.6958 | 50415 passed survival rate |
| 20-6439-4953 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.8590 | 50416 passed survival rate |
| 00-6645-7239 | Survival Rate | Equal Variance t Two-Sample Test | 0.0984 | 50417 passed survival rate |
| 19-6349-3879 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7513 | 50418 passed survival rate |
| 04-7782-0370 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9615 | 50419 passed survival rate |
| 06-1296-7087 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.6958 | 50420 passed survival rate |
| 17-0371-2318 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5718 | 50421 passed survival rate |
| 01-6203-5445 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50422 passed survival rate |
| 01-8130-8615 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50423 passed survival rate |
| 20-6558-0137 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.6958 | 50424 passed survival rate |
| 19-5540-0769 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.4510 | 50425 passed survival rate |
| 02-6607-7224 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50426 passed survival rate |
| 01-9275-3006 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9615 | 50427 passed survival rate |
| 17-4745-8476 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50428 passed survival rate |
| 16-5669-9074 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.6958 | 50429 passed survival rate |
| 02-2793-3406 | Survival Rate | Equal Variance t Two-Sample Test | 0.0231 | 50430 failed survival rate |
| 15-1635-6499 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7513 | 50431 passed survival rate |
| 17-7705-2676 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.8590 | 50432 passed survival rate |
| 09-3145-0864 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.8590 | 50433 passed survival rate |
| 13-2120-6205 | Survival Rate | Equal Variance t Two-Sample Test | 0.1398 | 50434 passed survival rate |

### Mean Dry Weight-mg Summary

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | 0.13 | 0.2 | 0.008238 | 0.0233 | 14.43% | 0.00% |
| 50415 | | 8 | 0.1415 | 0.1253 | 0.1577 | 0.124 | 0.184 | 0.006843 | 0.01935 | 13.68% | 12.39% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | 0.116 | 0.159 | 0.00553 | 0.01564 | 11.25% | 13.93% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.093 | 0.1533 | 0.00692 | 0.01957 | 15.42% | 21.41% |
| 50418 | | 8 | 0.1404 | 0.1245 | 0.1563 | 0.109 | 0.1556 | 0.006722 | 0.01901 | 13.54% | 13.07% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | 0.1144 | 0.154 | 0.005108 | 0.01445 | 10.60% | 15.60% |
| 50420 | | 8 | 0.1477 | 0.1306 | 0.1648 | 0.1144 | 0.1744 | 0.007228 | 0.02044 | 13.84% | 8.53% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | 0.114 | 0.1714 | 0.006377 | 0.01804 | 13.71% | 18.52% |
| 50422 | | 8 | 0.1485 | 0.1189 | 0.1781 | 0.1078 | 0.22 | 0.01251 | 0.03537 | 23.82% | 8.03% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | 0.09 | 0.1678 | 0.008523 | 0.02411 | 18.46% | 19.13% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | 0.11 | 0.163 | 0.00706 | 0.01997 | 14.62% | 15.40% |
| 50425 | | 8 | 0.1501 | 0.09243 | 0.2079 | 0.02444 | 0.2778 | 0.02441 | 0.06903 | 45.98% | 7.02% |
| 50426 | | 8 | 0.1498 | 0.1339 | 0.1656 | 0.122 | 0.181 | 0.006695 | 0.01894 | 12.65% | 7.27% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | 0.111 | 0.1611 | 0.00673 | 0.01904 | 14.49% | 18.64% |
| 50428 | | 8 | 0.1449 | 0.1264 | 0.1635 | 0.1143 | 0.189 | 0.00785 | 0.0222 | 15.32% | 10.26% |
| 50429 | | 8 | 0.1427 | 0.1234 | 0.1621 | 0.095 | 0.1633 | 0.008179 | 0.02314 | 16.21% | 11.60% |
| 50430 | | 8 | 0.1147 | 0.0993 | 0.1302 | 0.08444 | 0.1437 | 0.006525 | 0.01846 | 16.09% | 28.96% |
| 50431 | | 8 | 0.1501 | 0.1279 | 0.1723 | 0.1137 | 0.188 | 0.009391 | 0.02656 | 17.70% | 7.05% |
| 50432 | | 8 | 0.1458 | 0.1295 | 0.1621 | 0.1156 | 0.17 | 0.006884 | 0.01947 | 13.35% | 9.71% |
| 50433 | | 8 | 0.1432 | 0.1241 | 0.1623 | 0.09556 | 0.161 | 0.008064 | 0.02281 | 15.93% | 11.33% |
| 50434 | | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1389 | 0.1775 | 0.004617 | 0.01306 | 8.50% | 4.87% |

### Survival Rate Summary

| Conc-% | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.9500 | 0.8868 | 1.0000 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 7.96% | 0.00% |
| 50415 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -1.32% |
| 50416 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | -2.63% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | 5.26% |
| 50418 | | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | -1.32% |
| 50419 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -3.95% |
| 50420 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -1.32% |
| 50421 | | 8 | 0.9375 | 0.8382 | 1.0000 | 0.7000 | 1.0000 | 0.0420 | 0.1188 | 12.67% | 1.32% |
| 50422 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 1.32% |
| 50423 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 0.00% |
| 50424 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -1.32% |
| 50425 | | 8 | 0.9375 | 0.8753 | 0.9997 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.94% | 1.32% |
| 50426 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 0.00% |
| 50427 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -3.95% |
| 50428 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 1.32% |
| 50429 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -1.32% |
| 50430 | | 8 | 0.8375 | 0.7286 | 0.9464 | 0.6000 | 1.0000 | 0.0461 | 0.1302 | 15.55% | 11.84% |
| 50431 | | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | -1.32% |
| 50432 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | -2.63% |
| 50433 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | -2.63% |
| 50434 | | 8 | 0.9125 | 0.8589 | 0.9661 | 0.8000 | 1.0000 | 0.0227 | 0.0641 | 7.02% | 3.95% |

# CETIS Analytical Report

Report Date: 02 Sep-17 14:43 (p 1 of 2)
Test Code: 80595 | 02-2391-8794

**Hyalella 10-d Survival and Growth Sediment Test** — Aquatec Environmental, Inc.

| Analysis ID: | 02-2793-3406 | Endpoint: | Survival Rate | CETIS Version: | CETISv1.9.2 |
|---|---|---|---|---|---|
| Analyzed: | 02 Sep-17 14:15 | Analysis: | Parametric-Two Sample | Official Results: | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 46d 4h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Angular (Corrected) | C > T | 50430 failed survival rate | 8.20% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Control Sed | 50430* | 2.187 | 1.761 | 0.128 | 14 | CDF | 0.0231 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.101242 | 0.101242 | 1 | 4.784 | 0.0462 | Significant Effect |
| Error | 0.296302 | 0.0211645 | 14 | | | |
| Total | 0.397544 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.076 | 8.885 | 0.3561 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8506 | 0.8408 | 0.0139 | Normal Distribution |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.9500 | 0.8868 | 1.0000 | | 0.8000 | 1.0000 | 0.0267 | 7.96% | 0.00% |
| 50430 | | 8 | 0.8375 | 0.7286 | 0.9464 | | 0.6000 | 1.0000 | 0.0461 | 15.55% | 11.84% |

### Angular (Corrected) Transformed Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 1.333 | 1.235 | 1.431 | | 1.107 | 1.412 | 0.04147 | 8.80% | 0.00% |
| 50430 | | 8 | 1.174 | 1.033 | 1.315 | | 0.8861 | 1.412 | 0.05976 | 14.40% | 11.93% |

### Survival Rate Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.9000 | 1.0000 | 1.0000 | 0.8000 | 1.0000 | 1.0000 | 0.9000 | 1.0000 |
| 50430 | | 0.9000 | 0.6000 | 0.9000 | 0.8000 | 0.9000 | 0.9000 | 0.7000 | 1.0000 |

## CETIS Analytical Report

| | |
|---|---|
| Report Date: | 02 Sep-17 14:41 (p 1 of 1) |
| Test Code: | 80595 \| 02-2391-8794 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 02-7197-7953 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50415 | 05-7381-9684 | 07 Jun-17 10:00 | 15 Jun-17 16:35 | 51d 5h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50415 | Sediment | PEPCO Benning Rd-Waterside In | SED6C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50415 failed mean dry weight-mg | 11.68% |

### Equal Variance t Two-Sample Test

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50415* | 1.869 | 1.761 | 0.019 | 14 | CDF | 0.0414 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0016022 | 0.0016022 | 1 | 3.493 | 0.0827 | Non-Significant Effect |
| Error | 0.0064223 | 0.0004587 | 14 | | | |
| Total | 0.0080246 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.449 | 8.885 | 0.6367 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9243 | 0.8408 | 0.1979 | Normal Distribution |

### Mean Dry Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50415 | | 8 | 0.1415 | 0.1253 | 0.1577 | | 0.124 | 0.184 | 0.006843 | 13.68% | 12.39% |

### Mean Dry Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50415 | | 0.1467 | 0.184 | 0.142 | 0.129 | 0.1244 | 0.124 | 0.1367 | 0.145 |

# CETIS Analytical Report

| | | | |
|---|---|---|---|
| Report Date: | 02 Sep-17 14:41 (p 1 of 1) | | |
| Test Code: | 80595 \| 02-2391-8794 | | |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 08-8756-8177 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50416 | 17-8931-1896 | 07 Jun-17 11:30 | 15 Jun-17 16:35 | 51d 3h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50416 | Sediment | PEPCO Benning Rd-Waterside In | SED8C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50416 failed mean dry weight-mg | 10.82% |

**Equal Variance t Two-Sample Test**

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50416* | 2.268 | 1.761 | 0.017 | 14 | CDF | 0.0199 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0020250 | 0.0020250 | 1 | 5.143 | 0.0397 | Significant Effect |
| Error | 0.0055127 | 0.0003938 | 14 | | | |
| Total | 0.0075377 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.219 | 8.885 | 0.3149 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9631 | 0.8408 | 0.7188 | Normal Distribution |

**Mean Dry Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | | 0.116 | 0.159 | 0.00553 | 11.25% | 13.93% |

**Mean Dry Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50416 | | 0.149 | 0.1256 | 0.116 | 0.159 | 0.135 | 0.1433 | 0.127 | 0.157 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 13-3859-9717 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 51d 2h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean dry weight-mg | 11.73% |

**Equal Variance t Two-Sample Test**

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50417* | 3.214 | 1.761 | 0.019 | 14 | CDF | 0.0031 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0047831 | 0.0047831 | 1 | 10.33 | 0.0062 | Significant Effect |
| Error | 0.0064819 | 0.000463 | 14 | | | |
| Total | 0.011265 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.417 | 8.885 | 0.6571 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9615 | 0.8408 | 0.6888 | Normal Distribution |

**Mean Dry Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | | 0.093 | 0.1533 | 0.00692 | 15.42% | 21.41% |

**Mean Dry Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50417 | | 0.093 | 0.141 | 0.145 | 0.1311 | 0.1533 | 0.12 | 0.1163 | 0.1156 |

## CETIS Analytical Report

Report Date: 02 Sep-17 14:41 (p 1 of 1)
Test Code: 80595 | 02-2391-8794

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 10-6572-0343 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50418 | 08-2555-0475 | 08 Jun-17 08:30 | 15 Jun-17 16:35 | 50d 6h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50418 | Sediment | PEPCO Benning Rd-Waterside In | SED7F00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50418 failed mean dry weight-mg | 11.60% |

### Equal Variance t Two-Sample Test

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50418* | 1.985 | 1.761 | 0.019 | 14 | CDF | 0.0335 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0017816 | 0.0017816 | 1 | 3.94 | 0.0671 | Non-Significant Effect |
| Error | 0.0063302 | 0.0004522 | 14 | | | |
| Total | 0.0081117 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.502 | 8.885 | 0.6047 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9492 | 0.8408 | 0.4778 | Normal Distribution |

### Mean Dry Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50418 | | 8 | 0.1404 | 0.1245 | 0.1563 | | 0.109 | 0.1556 | 0.006722 | 13.54% | 13.07% |

### Mean Dry Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50418 | | 0.112 | 0.1525 | 0.141 | 0.149 | 0.155 | 0.149 | 0.109 | 0.1556 |

## CETIS Analytical Report

Report Date: 02 Sep-17 14:42 (p 1 of 1)
Test Code: 80595 | 02-2391-8794

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 12-3701-8521 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 50d 5h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean dry weight-mg | 10.57% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Control Sed | 50419* | 2.599 | 1.761 | 0.017 | 14 | CDF | 0.0105 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0025391 | 0.0025391 | 1 | 6.756 | 0.0210 | Significant Effect |
| Error | 0.0052612 | 0.0003758 | 14 | | | |
| Total | 0.0078003 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.601 | 8.885 | 0.2305 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9711 | 0.8408 | 0.8556 | Normal Distribution |

### Mean Dry Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | | 0.1144 | 0.154 | 0.005108 | 10.60% | 15.60% |

### Mean Dry Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50419 | | 0.141 | 0.123 | 0.124 | 0.136 | 0.1144 | 0.149 | 0.1489 | 0.154 |

# CETIS Analytical Report

| | | | |
|---|---|---|---|
| **Report Date:** | 02 Sep-17 14:42 (p 1 of 1) | | |
| **Test Code:** | 80595 \| 02-2391-8794 | | |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 09-7798-3999 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50421 | 10-8432-1021 | 08 Jun-17 10:30 | 15 Jun-17 16:35 | 50d 4h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50421 | Sediment | PEPCO Benning Rd-Waterside In | SED7E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50421 failed mean dry weight-mg | 11.36% |

**Equal Variance t Two-Sample Test**

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50421* | 2.87 | 1.761 | 0.018 | 14 | CDF | 0.0062 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0035764 | 0.0035764 | 1 | 8.239 | 0.0123 | Significant Effect |
| Error | 0.0060774 | 0.0004341 | 14 | | | |
| Total | 0.0096538 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.669 | 8.885 | 0.5155 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9134 | 0.8408 | 0.1319 | Normal Distribution |

**Mean Dry Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | | 0.114 | 0.1714 | 0.006377 | 13.71% | 18.52% |

**Mean Dry Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50421 | | 0.123 | 0.119 | 0.1263 | 0.1714 | 0.141 | 0.126 | 0.114 | 0.132 |

## CETIS Analytical Report

Report Date: 02 Sep-17 14:42 (p 1 of 1)
Test Code: 80595 | 02-2391-8794

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 13-0087-5995 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50423 | 06-3488-3136 | 08 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 1h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50423 | Sediment | PEPCO Benning Rd-Waterside In | SED6A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50423 failed mean dry weight-mg | 12.93% |

### Equal Variance t Two-Sample Test

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Control Sed | | 50423* | 2.606 | 1.761 | 0.021 | 14 | CDF | 0.0104 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0038157 | 0.0038157 | 1 | 6.79 | 0.0207 | Significant Effect |
| Error | 0.0078677 | 0.000562 | 14 | | | |
| Total | 0.0116834 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.07 | 8.885 | 0.9308 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.949 | 0.8408 | 0.4735 | Normal Distribution |

### Mean Dry Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | | 0.09 | 0.1678 | 0.008523 | 18.46% | 19.13% |

### Mean Dry Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50423 | | 0.1212 | 0.1267 | 0.09 | 0.1678 | 0.147 | 0.116 | 0.1511 | 0.125 |

## CETIS Analytical Report

Report Date: 02 Sep-17 14:42 (p 1 of 1)
Test Code: 80595 | 02-2391-8794

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 12-3264-0886 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50424 | 00-7068-4401 | 09 Jun-17 08:15 | 15 Jun-17 16:35 | 49d 6h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50424 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50424 failed mean dry weight-mg | 11.83% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Control Sed | 50424* | 2.293 | 1.761 | 0.019 | 14 | CDF | 0.0189 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0024751 | 0.0024751 | 1 | 5.257 | 0.0379 | Significant Effect |
| Error | 0.0065916 | 0.0004708 | 14 | | | |
| Total | 0.0090667 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.361 | 8.885 | 0.6943 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9554 | 0.8408 | 0.5805 | Normal Distribution |

**Mean Dry Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | | 0.11 | 0.163 | 0.00706 | 14.62% | 15.40% |

**Mean Dry Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50424 | | 0.1267 | 0.163 | 0.11 | 0.144 | 0.157 | 0.1122 | 0.15 | 0.13 |

# CETIS Analytical Report

| Report Date: | 02 Sep-17 14:43 (p 1 of 1) |
|---|---|
| Test Code: | 80595 \| 02-2391-8794 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 05-1548-6413 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50427 | 18-6592-9282 | 09 Jun-17 10:30 | 15 Jun-17 16:35 | 49d 4h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50427 | Sediment | PEPCO Benning Rd-Waterside In | SED8A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50427 failed mean dry weight-mg | 11.60% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Control Sed | 50427* | 2.829 | 1.761 | 0.019 | 14 | CDF | 0.0067 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0036234 | 0.0036234 | 1 | 8.005 | 0.0134 | Significant Effect |
| Error | 0.0063366 | 0.0004526 | 14 | | | |
| Total | 0.00996 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.498 | 8.885 | 0.6070 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9277 | 0.8408 | 0.2240 | Normal Distribution |

**Mean Dry Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | | 0.111 | 0.1611 | 0.00673 | 14.49% | 18.64% |

**Mean Dry Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50427 | | 0.128 | 0.119 | 0.157 | 0.111 | 0.118 | 0.139 | 0.1611 | 0.118 |

## CETIS Analytical Report

| | |
|---|---|
| **Report Date:** | 02 Sep-17 14:43 (p 1 of 1) |
| **Test Code:** | 80595 \| 02-2391-8794 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 19-8497-1087 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:14 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50413 | 17-0005-8020 | 19 Jun-17 08:30 | 14 Jun-17 09:30 | 39d 6h | Aquatec Environmental, I | Sediment Testing |
| 50430 | 00-4062-0315 | 12 Jun-17 10:15 | 15 Jun-17 16:35 | 46d 4h | AECOM (MA) | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50413 | Control Sediment | Internal Laboratory Testing | Control | |
| 50430 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1600N | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50430 failed mean dry weight-mg | 11.46% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Control Sed | 50430* | 4.449 | 1.761 | 0.019 | 14 | CDF | 2.7E-04 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0087458 | 0.0087458 | 1 | 19.8 | 5.5E-04 | Significant Effect |
| Error | 0.0061846 | 0.0004418 | 14 | | | |
| Total | 0.0149304 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.594 | 8.885 | 0.5536 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9789 | 0.8408 | 0.9542 | Normal Distribution |

**Mean Dry Weight-mg Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 8 | 0.1615 | 0.142 | 0.181 | | 0.13 | 0.2 | 0.008238 | 14.43% | 0.00% |
| 50430 | | 8 | 0.1147 | 0.0993 | 0.1302 | | 0.08444 | 0.1437 | 0.006525 | 16.09% | 28.96% |

**Mean Dry Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | CS | 0.13 | 0.156 | 0.154 | 0.2 | 0.144 | 0.182 | 0.1789 | 0.147 |
| 50430 | | 0.1144 | 0.1233 | 0.1211 | 0.1437 | 0.08444 | 0.09444 | 0.1243 | 0.112 |

## CETIS Test Data Worksheet

Report Date: 02 Sep-17 14:13 (p 1 of 4)
Test Code/ID: 02-2391-8794/80595

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Start Date:** | 28 Jul-17 14:40 | **Species:** | Hyalella azteca | **Sample Code:** | 50413 |
| **End Date:** | 07 Aug-17 16:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Sample Source:** | Internal Laboratory Testing |
| **Sample Date:** | 19 Jun-17 08:30 | **Material:** | Control Sediment | **Sample Station:** | Control |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50413 | 1 | 59 | 10 | 9 | 25.16 | 23.99 | 9 | | |
| 50413 | 2 | 64 | 10 | 10 | 24.54 | 22.98 | 10 | | |
| 50413 | 3 | 142 | 10 | 10 | 27.59 | 26.05 | 10 | | |
| 50413 | 4 | 70 | 10 | 8 | 24.58 | 22.98 | 8 | | |
| 50413 | 5 | 47 | 10 | 10 | 26.1 | 24.66 | 10 | | |
| 50413 | 6 | 127 | 10 | 10 | 25.65 | 23.83 | 10 | | |
| 50413 | 7 | 164 | 10 | 9 | 25.54 | 23.93 | 9 | | |
| 50413 | 8 | 121 | 10 | 10 | 25.32 | 23.85 | 10 | | |
| 50415 | 1 | 145 | 10 | 9 | 23.34 | 22.02 | 9 | | |
| 50415 | 2 | 61 | 10 | 10 | 26.1 | 24.26 | 10 | | |
| 50415 | 3 | 56 | 10 | 10 | 25.07 | 23.65 | 10 | | |
| 50415 | 4 | 105 | 10 | 10 | 25.77 | 24.48 | 10 | | |
| 50415 | 5 | 126 | 10 | 9 | 23.64 | 22.52 | 9 | | |
| 50415 | 6 | 60 | 10 | 10 | 24.4 | 23.16 | 10 | | |
| 50415 | 7 | 36 | 10 | 9 | 26.58 | 25.35 | 9 | | |
| 50415 | 8 | 83 | 10 | 10 | 25.06 | 23.61 | 10 | | |
| 50416 | 1 | 129 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50416 | 2 | 9 | 10 | 9 | 24.87 | 23.74 | 9 | | |
| 50416 | 3 | 20 | 10 | 10 | 24.82 | 23.66 | 10 | | |
| 50416 | 4 | 32 | 10 | 10 | 24.62 | 23.03 | 10 | | |
| 50416 | 5 | 81 | 10 | 10 | 25.24 | 23.89 | 10 | | |
| 50416 | 6 | 157 | 10 | 9 | 23.17 | 21.88 | 9 | | |
| 50416 | 7 | 55 | 10 | 10 | 25.3 | 24.03 | 10 | | |
| 50416 | 8 | 52 | 10 | 10 | 25.07 | 23.5 | 10 | | |
| 50417 | 1 | 65 | 10 | 10 | 26.02 | 25.09 | 10 | | |
| 50417 | 2 | 119 | 10 | 10 | 25.21 | 23.8 | 10 | | |
| 50417 | 3 | 138 | 10 | 8 | 24.97 | 23.81 | 8 | | |
| 50417 | 4 | 158 | 10 | 9 | 24.18 | 23 | 9 | | |
| 50417 | 5 | 103 | 10 | 9 | 25.62 | 24.24 | 9 | | |
| 50417 | 6 | 21 | 10 | 9 | 24.68 | 23.6 | 9 | | |
| 50417 | 7 | 66 | 10 | 8 | 24.49 | 23.56 | 8 | | |
| 50417 | 8 | 44 | 10 | 9 | 25.33 | 24.29 | 9 | | |
| 50418 | 1 | 166 | 10 | 10 | 25.27 | 24.15 | 10 | | |
| 50418 | 2 | 108 | 10 | 8 | 23.73 | 22.51 | 8 | | |
| 50418 | 3 | 33 | 10 | 10 | 24.42 | 23.01 | 10 | | |
| 50418 | 4 | 89 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50418 | 5 | 163 | 10 | 10 | 24.4 | 22.85 | 10 | | |
| 50418 | 6 | 16 | 10 | 10 | 25.19 | 23.7 | 10 | | |
| 50418 | 7 | 162 | 10 | 10 | 26.56 | 25.47 | 10 | | |
| 50418 | 8 | 117 | 10 | 9 | 25.08 | 23.68 | 9 | | |
| 50419 | 1 | 86 | 10 | 10 | 24.88 | 23.47 | 10 | | |
| 50419 | 2 | 41 | 10 | 10 | 24.25 | 23.02 | 10 | | |
| 50419 | 3 | 113 | 10 | 10 | 24.8 | 23.56 | 10 | | |
| 50419 | 4 | 168 | 10 | 10 | 23.27 | 21.91 | 10 | | |
| 50419 | 5 | 10 | 10 | 10 | 24.23 | 23.2 | 9 | | |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 37 | 10 | 10 | 24.88 | 23.39 | 10 | | |
| 50419 | 7 | 38 | 10 | 9 | 24.97 | 23.63 | 9 | | |
| 50419 | 8 | 58 | 10 | 10 | 24.04 | 22.5 | 10 | | |
| 50420 | 1 | 14 | 10 | 9 | 24.29 | 22.72 | 9 | | |
| 50420 | 2 | 54 | 10 | 9 | 24.81 | 23.78 | 9 | | |
| 50420 | 3 | 4 | 10 | 10 | 25.35 | 23.9 | 10 | | |
| 50420 | 4 | 49 | 10 | 10 | 23.78 | 22.45 | 10 | | |
| 50420 | 5 | 120 | 10 | 10 | 24.63 | 23.14 | 10 | | |
| 50420 | 6 | 18 | 10 | 10 | 26.24 | 24.51 | 10 | | |
| 50420 | 7 | 155 | 10 | 9 | 22.9 | 21.68 | 9 | | |
| 50420 | 8 | 48 | 11 | 11 | 27.94 | 26.21 | 11 | | |
| 50421 | 1 | 23 | 10 | 10 | 23.94 | 22.71 | 10 | | |
| 50421 | 2 | 137 | 10 | 10 | 24.16 | 22.97 | 10 | | |
| 50421 | 3 | 75 | 10 | 8 | 23.59 | 22.58 | 8 | | |
| 50421 | 4 | 76 | 10 | 7 | 26.01 | 24.81 | 7 | | |
| 50421 | 5 | 91 | 10 | 10 | 24.91 | 23.5 | 10 | | |
| 50421 | 6 | 29 | 10 | 10 | 24.23 | 22.97 | 10 | | |
| 50421 | 7 | 132 | 10 | 10 | 25.57 | 24.43 | 10 | | |
| 50421 | 8 | 25 | 10 | 10 | 25.11 | 23.79 | 10 | | |
| 50422 | 1 | 78 | 10 | 9 | 23.17 | 22.2 | 9 | | |
| 50422 | 2 | 102 | 10 | 10 | 25.72 | 24.25 | 10 | | |
| 50422 | 3 | 67 | 10 | 7 | 24.59 | 23.05 | 7 | | |
| 50422 | 4 | 53 | 10 | 10 | 24.1 | 22.82 | 10 | | |
| 50422 | 5 | 26 | 10 | 10 | 26.46 | 24.8 | 10 | | |
| 50422 | 6 | 128 | 10 | 9 | 24.75 | 23.55 | 9 | | |
| 50422 | 7 | 144 | 10 | 10 | 24.48 | 22.83 | 10 | | |
| 50422 | 8 | 110 | 10 | 10 | 24.69 | 23.48 | 10 | | |
| 50423 | 1 | 35 | 10 | 9 | 23.64 | 22.67 | 8 | | |
| 50423 | 2 | 130 | 10 | 9 | 25.33 | 24.19 | 9 | | |
| 50423 | 3 | 87 | 11 | 11 | 24.46 | 23.47 | 11 | | |
| 50423 | 4 | 160 | 10 | 9 | 25.27 | 23.76 | 9 | | |
| 50423 | 5 | 42 | 10 | 10 | 25.38 | 23.91 | 10 | | |
| 50423 | 6 | 72 | 10 | 10 | 22.79 | 21.63 | 10 | | |
| 50423 | 7 | 74 | 10 | 9 | 23.8 | 22.44 | 9 | | |
| 50423 | 8 | 24 | 10 | 10 | 24.53 | 23.28 | 10 | | |
| 50424 | 1 | 122 | 10 | 9 | 23.04 | 21.9 | 9 | | |
| 50424 | 2 | 79 | 10 | 10 | 23.67 | 22.04 | 10 | | |
| 50424 | 3 | 11 | 10 | 10 | 23.34 | 22.24 | 10 | | |
| 50424 | 4 | 3 | 10 | 10 | 24.56 | 23.12 | 10 | | |
| 50424 | 5 | 154 | 10 | 10 | 24.84 | 23.27 | 10 | | |
| 50424 | 6 | 50 | 10 | 9 | 23.87 | 22.86 | 9 | | |
| 50424 | 7 | 148 | 10 | 10 | 24.69 | 23.19 | 10 | | |
| 50424 | 8 | 57 | 10 | 9 | 24.05 | 22.88 | 9 | | |
| 50425 | 1 | 73 | 10 | 8 | 24.5 | 23.17 | 8 | | |
| 50425 | 2 | 1 | 10 | 10 | 23.31 | 21.76 | 10 | | |
| 50425 | 3 | 107 | 10 | 10 | 24.12 | 22.73 | 10 | | |
| 50425 | 4 | 147 | 10 | 10 | 23.22 | 21.63 | 10 | | |
| 50425 | 5 | 96 | 10 | 10 | 25.86 | 24.63 | 10 | | |
| 50425 | 6 | 124 | 10 | 9 | 23.13 | 22.91 | 9 | | |
| 50425 | 7 | 131 | 10 | 9 | 25.38 | 23.97 | 9 | | |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 159 | 10 | 9 | 26.9 | 24.4 | 9 | | |
| 50426 | 1 | 141 | 10 | 9 | 25.12 | 23.93 | 9 | | |
| 50426 | 2 | 6 | 10 | 9 | 24.84 | 23.47 | 9 | | |
| 50426 | 3 | 153 | 10 | 10 | 25.04 | 23.82 | 10 | | |
| 50426 | 4 | 97 | 10 | 9 | 25.87 | 24.56 | 9 | | |
| 50426 | 5 | 111 | 10 | 9 | 23.83 | 22.39 | 9 | | |
| 50426 | 6 | 92 | 10 | 10 | 24.8 | 23.15 | 10 | | |
| 50426 | 7 | 39 | 10 | 10 | 24.74 | 22.93 | 10 | | |
| 50426 | 8 | 34 | 10 | 10 | 23.83 | 22.43 | 10 | | |
| 50427 | 1 | 161 | 10 | 10 | 24.83 | 23.55 | 10 | | |
| 50427 | 2 | 19 | 10 | 10 | 25.06 | 23.87 | 10 | | |
| 50427 | 3 | 134 | 10 | 10 | 23.27 | 21.7 | 10 | | |
| 50427 | 4 | 30 | 10 | 10 | 24.39 | 23.28 | 10 | | |
| 50427 | 5 | 8 | 10 | 10 | 24.48 | 23.3 | 10 | | |
| 50427 | 6 | 7 | 10 | 10 | 24.11 | 22.72 | 10 | | |
| 50427 | 7 | 71 | 10 | 9 | 25.14 | 23.69 | 9 | | |
| 50427 | 8 | 40 | 10 | 10 | 24.12 | 22.94 | 10 | | |
| 50428 | 1 | 156 | 10 | 10 | 24.98 | 23.79 | 9 | | |
| 50428 | 2 | 115 | 10 | 10 | 26.1 | 24.21 | 10 | | |
| 50428 | 3 | 98 | 10 | 10 | 24.77 | 23.52 | 9 | | |
| 50428 | 4 | 112 | 10 | 9 | 23.63 | 22.42 | 9 | | |
| 50428 | 5 | 80 | 10 | 9 | 24.89 | 23.59 | 9 | | |
| 50428 | 6 | 69 | 10 | 10 | 25.09 | 23.64 | 9 | | |
| 50428 | 7 | 165 | 10 | 10 | 23.04 | 21.59 | 10 | | |
| 50428 | 8 | 22 | 10 | 7 | 25.46 | 24.66 | 7 | | |
| 50429 | 1 | 118 | 10 | 10 | 23.63 | 22.31 | 10 | | |
| 50429 | 2 | 77 | 10 | 10 | 29.23 | 27.73 | 10 | | |
| 50429 | 3 | 140 | 10 | 10 | 25.02 | 23.43 | 10 | | |
| 50429 | 4 | 104 | 10 | 9 | 24.91 | 23.68 | 8 | | |
| 50429 | 5 | 125 | 10 | 9 | 25.29 | 23.82 | 9 | | |
| 50429 | 6 | 2 | 10 | 9 | 25.27 | 24.11 | 9 | | |
| 50429 | 7 | 106 | 10 | 10 | 22.75 | 21.8 | 10 | | |
| 50429 | 8 | 143 | 10 | 10 | 24.32 | 22.72 | 10 | | |
| 50430 | 1 | 82 | 10 | 9 | 25.09 | 24.06 | 9 | | |
| 50430 | 2 | 114 | 10 | 6 | 23.64 | 22.9 | 6 | | |
| 50430 | 3 | 12 | 10 | 9 | 23.94 | 22.85 | 9 | | |
| 50430 | 4 | 90 | 10 | 8 | 24.48 | 23.33 | 8 | | |
| 50430 | 5 | 27 | 10 | 9 | 23.59 | 22.83 | 9 | | |
| 50430 | 6 | 149 | 10 | 9 | 23.77 | 22.92 | 9 | | |
| 50430 | 7 | 99 | 10 | 7 | 24.97 | 24.1 | 7 | | |
| 50430 | 8 | 68 | 10 | 10 | 24.85 | 23.73 | 10 | | |
| 50431 | 1 | 5 | 10 | 9 | 24.79 | 23.62 | 9 | | |
| 50431 | 2 | 93 | 10 | 10 | 28.14 | 26.59 | 10 | | |
| 50431 | 3 | 116 | 10 | 10 | 24.86 | 23.56 | 10 | | |
| 50431 | 4 | 139 | 10 | 10 | 25.87 | 24.27 | 10 | | |
| 50431 | 5 | 167 | 10 | 10 | 25.16 | 23.76 | 10 | | |
| 50431 | 6 | 88 | 10 | 10 | 25.59 | 23.75 | 10 | | |
| 50431 | 7 | 94 | 10 | 10 | 26.32 | 24.44 | 10 | | |
| 50431 | 8 | 46 | 10 | 8 | 26.21 | 25.3 | 8 | | |
| 50432 | 1 | 17 | 10 | 9 | 24.24 | 22.94 | 9 | | |

| Conc-% | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | 2 | 95 | 10 | 9 | 26.74 | 25.24 | 9 | | |
| 50432 | 3 | 100 | 10 | 10 | 25.49 | 23.91 | 10 | | |
| 50432 | 4 | 63 | 10 | 10 | 23.65 | 22.39 | 10 | | |
| 50432 | 5 | 43 | 10 | 10 | 24.84 | 23.8 | 9 | | |
| 50432 | 6 | 13 | 10 | 10 | 24.77 | 23.07 | 10 | | |
| 50432 | 7 | 31 | 10 | 10 | 23.99 | 22.65 | 10 | | |
| 50432 | 8 | 146 | 11 | 11 | 24.81 | 23.14 | 11 | | |
| 50433 | 1 | 133 | 10 | 10 | 25.29 | 23.75 | 10 | | |
| 50433 | 2 | 28 | 10 | 10 | 24.37 | 22.76 | 10 | | |
| 50433 | 3 | 123 | 10 | 10 | 24.29 | 22.68 | 10 | | |
| 50433 | 4 | 152 | 10 | 9 | 23.34 | 22.48 | 9 | | |
| 50433 | 5 | 151 | 10 | 10 | 25.1 | 23.77 | 10 | | |
| 50433 | 6 | 101 | 10 | 9 | 25.09 | 23.92 | 9 | | |
| 50433 | 7 | 85 | 10 | 10 | 25.68 | 24.08 | 10 | | |
| 50433 | 8 | 136 | 10 | 10 | 25.1 | 23.59 | 10 | | |
| 50434 | 1 | 45 | 10 | 9 | 23.85 | 22.71 | 8 | | |
| 50434 | 2 | 84 | 10 | 9 | 24.17 | 22.73 | 9 | | |
| 50434 | 3 | 150 | 10 | 9 | 24.23 | 22.92 | 9 | | |
| 50434 | 4 | 62 | 10 | 9 | 23.29 | 21.8 | 9 | | |
| 50434 | 5 | 15 | 10 | 8 | 25.28 | 23.86 | 8 | | |
| 50434 | 6 | 51 | 10 | 9 | 24.9 | 23.65 | 9 | | |
| 50434 | 7 | 109 | 10 | 10 | 24.96 | 23.47 | 10 | | |
| 50434 | 8 | 135 | 10 | 10 | 24.4 | 22.9 | 10 | | |

*Hyalella azteca*

10-day survival and

growth test (dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1600N

(Aquatec Sample # 50430)

STATISTICAL COMPARISONS TO 50430 (SED BACKGROUND)

## CETIS Summary Report

Report Date: 02 Sep-17 14:39 (p 1 of 2)
Test Code: 80611 | 14-7663-7880

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 00-8077-4874 | **Test Type:** | Survival-Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 28 Jul-17 14:40 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 07 Aug-17 16:30 | **Species:** | Hyalella azteca | **Brine:** | |
| **Duration:** | 10d 2h | **Source:** | Aquatic Biosystems, CO | **Age:** | 12d |

### Single Comparison Summary

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 17-9559-7254 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9933 | 50415 passed mean dry weight-mg |
| 15-1055-9281 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9934 | 50416 passed mean dry weight-mg |
| 05-8757-3743 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.8894 | 50417 passed mean dry weight-mg |
| 13-6829-1787 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9920 | 50418 passed mean dry weight-mg |
| 03-0340-2309 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9896 | 50419 passed mean dry weight-mg |
| 19-5239-6355 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9978 | 50420 passed mean dry weight-mg |
| 21-4206-2683 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9571 | 50421 passed mean dry weight-mg |
| 08-4941-4730 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9844 | 50422 passed mean dry weight-mg |
| 11-8077-1608 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9193 | 50423 passed mean dry weight-mg |
| 06-3351-9115 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9805 | 50424 passed mean dry weight-mg |
| 12-5731-3853 | Mean Dry Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.9859 | 50425 passed mean dry weight-mg |
| 06-5629-6033 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9989 | 50426 passed mean dry weight-mg |
| 09-1698-7212 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9514 | 50427 passed mean dry weight-mg |
| 01-8793-4212 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9948 | 50428 passed mean dry weight-mg |
| 20-9900-2798 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.9910 | 50429 passed mean dry weight-mg |
| 11-1929-8567 | Survival Rate | Equal Variance t Two-Sample Test | 0.9904 | 50415 passed survival rate |
| 00-2459-8227 | Survival Rate | Equal Variance t Two-Sample Test | 0.9953 | 50416 passed survival rate |
| 19-2838-3671 | Survival Rate | Equal Variance t Two-Sample Test | 0.8570 | 50417 passed survival rate |
| 16-3391-3028 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9939 | 50418 passed survival rate |
| 08-8699-1195 | Survival Rate | Equal Variance t Two-Sample Test | 0.9980 | 50419 passed survival rate |
| 02-7928-8840 | Survival Rate | Equal Variance t Two-Sample Test | 0.9906 | 50420 passed survival rate |
| 03-3800-9544 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9781 | 50421 passed survival rate |
| 03-9556-9003 | Survival Rate | Equal Variance t Two-Sample Test | 0.9535 | 50422 passed survival rate |
| 08-5757-9949 | Survival Rate | Equal Variance t Two-Sample Test | 0.9825 | 50423 passed survival rate |
| 11-0164-4355 | Survival Rate | Equal Variance t Two-Sample Test | 0.9904 | 50424 passed survival rate |
| 13-6824-0834 | Survival Rate | Equal Variance t Two-Sample Test | 0.9619 | 50425 passed survival rate |
| 11-8325-3288 | Survival Rate | Equal Variance t Two-Sample Test | 0.9823 | 50426 passed survival rate |
| 13-8486-8528 | Survival Rate | Equal Variance t Two-Sample Test | 0.9980 | 50427 passed survival rate |
| 01-6259-9013 | Survival Rate | Equal Variance t Two-Sample Test | 0.9535 | 50428 passed survival rate |
| 08-8142-2998 | Survival Rate | Equal Variance t Two-Sample Test | 0.9904 | 50429 passed survival rate |

Hyalella 10-d Survival and Growth Sediment Test — Aquatec Environmental, Inc.

### Mean Dry Weight-mg Summary

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 0.1147 | 0.0993 | 0.1302 | 0.08444 | 0.1437 | 0.006525 | 0.01846 | 16.09% | 0.00% |
| 50415 | | 8 | 0.1415 | 0.1253 | 0.1577 | 0.124 | 0.184 | 0.006843 | 0.01935 | 13.68% | -23.31% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | 0.116 | 0.159 | 0.00553 | 0.01564 | 11.25% | -21.15% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.093 | 0.1533 | 0.00692 | 0.01957 | 15.42% | -10.62% |
| 50418 | | 8 | 0.1404 | 0.1245 | 0.1563 | 0.109 | 0.1556 | 0.006722 | 0.01901 | 13.54% | -22.36% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | 0.1144 | 0.154 | 0.005108 | 0.01445 | 10.60% | -18.80% |
| 50420 | | 8 | 0.1477 | 0.1306 | 0.1648 | 0.1144 | 0.1744 | 0.007228 | 0.02044 | 13.84% | -28.75% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | 0.114 | 0.1714 | 0.006377 | 0.01804 | 13.71% | -14.69% |
| 50422 | | 8 | 0.1485 | 0.1189 | 0.1781 | 0.1078 | 0.22 | 0.01251 | 0.03537 | 23.82% | -29.45% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | 0.09 | 0.1678 | 0.008523 | 0.02411 | 18.46% | -13.84% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | 0.11 | 0.163 | 0.00706 | 0.01997 | 14.62% | -19.08% |
| 50425 | | 8 | 0.1501 | 0.09243 | 0.2079 | 0.02444 | 0.2778 | 0.02441 | 0.06903 | 45.98% | -30.87% |
| 50426 | | 8 | 0.1498 | 0.1339 | 0.1656 | 0.122 | 0.181 | 0.006695 | 0.01894 | 12.65% | -30.53% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | 0.111 | 0.1611 | 0.00673 | 0.01904 | 14.49% | -14.52% |
| 50428 | | 8 | 0.1449 | 0.1264 | 0.1635 | 0.1143 | 0.189 | 0.00785 | 0.0222 | 15.32% | -26.32% |
| 50429 | | 8 | 0.1427 | 0.1234 | 0.1621 | 0.095 | 0.1633 | 0.008179 | 0.02314 | 16.21% | -24.42% |

### Survival Rate Summary

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50430 | RS | 8 | 0.8375 | 0.7286 | 0.9464 | 0.6000 | 1.0000 | 0.0461 | 0.1302 | 15.55% | 0.00% |
| 50415 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -14.93% |
| 50416 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | -16.42% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | -7.46% |
| 50418 | | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | -14.93% |
| 50419 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -17.91% |
| 50420 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -14.93% |
| 50421 | | 8 | 0.9375 | 0.8382 | 1.0000 | 0.7000 | 1.0000 | 0.0420 | 0.1188 | 12.67% | -11.94% |
| 50422 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | -11.94% |
| 50423 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | -13.43% |
| 50424 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -14.93% |
| 50425 | | 8 | 0.9375 | 0.8753 | 0.9997 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.94% | -11.94% |
| 50426 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | -13.43% |
| 50427 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -17.91% |
| 50428 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | -11.94% |
| 50429 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -14.93% |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

**Start Date:** 28 Jul-17 14:40 **Species:** Hyalella azteca **Sample Code:** 50430
**End Date:** 07 Aug-17 16:30 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** PEPCO Benning Rd-Waterside Inve
**Sample Date:** 12 Jun-17 10:15 **Material:** Reference sediment **Sample Station:** SEDBACK1600N

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50430 | 1 | 107 | 10 | 9 | 25.09 | 24.06 | 9 | | |
| 50430 | 2 | 127 | 10 | 6 | 23.64 | 22.9 | 6 | | |
| 50430 | 3 | 100 | 10 | 9 | 23.94 | 22.85 | 9 | | |
| 50430 | 4 | 57 | 10 | 8 | 24.48 | 23.33 | 8 | | |
| 50430 | 5 | 99 | 10 | 9 | 23.59 | 22.83 | 9 | | |
| 50430 | 6 | 65 | 10 | 9 | 23.77 | 22.92 | 9 | | |
| 50430 | 7 | 80 | 10 | 7 | 24.97 | 24.1 | 7 | | |
| 50430 | 8 | 25 | 10 | 10 | 24.85 | 23.73 | 10 | | |
| 50415 | 1 | 120 | 10 | 9 | 23.34 | 22.02 | 9 | | |
| 50415 | 2 | 79 | 10 | 10 | 26.1 | 24.26 | 10 | | |
| 50415 | 3 | 8 | 10 | 10 | 25.07 | 23.65 | 10 | | |
| 50415 | 4 | 98 | 10 | 10 | 25.77 | 24.48 | 10 | | |
| 50415 | 5 | 78 | 10 | 9 | 23.64 | 22.52 | 9 | | |
| 50415 | 6 | 90 | 10 | 10 | 24.4 | 23.16 | 10 | | |
| 50415 | 7 | 39 | 10 | 9 | 26.58 | 25.35 | 9 | | |
| 50415 | 8 | 124 | 10 | 10 | 25.06 | 23.61 | 10 | | |
| 50416 | 1 | 83 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50416 | 2 | 96 | 10 | 9 | 24.87 | 23.74 | 9 | | |
| 50416 | 3 | 81 | 10 | 10 | 24.82 | 23.66 | 10 | | |
| 50416 | 4 | 123 | 10 | 10 | 24.62 | 23.03 | 10 | | |
| 50416 | 5 | 36 | 10 | 10 | 25.24 | 23.89 | 10 | | |
| 50416 | 6 | 1 | 10 | 9 | 23.17 | 21.88 | 9 | | |
| 50416 | 7 | 34 | 10 | 10 | 25.3 | 24.03 | 10 | | |
| 50416 | 8 | 44 | 10 | 10 | 25.07 | 23.5 | 10 | | |
| 50417 | 1 | 12 | 10 | 10 | 26.02 | 25.09 | 10 | | |
| 50417 | 2 | 30 | 10 | 10 | 25.21 | 23.8 | 10 | | |
| 50417 | 3 | 59 | 10 | 8 | 24.97 | 23.81 | 8 | | |
| 50417 | 4 | 67 | 10 | 9 | 24.18 | 23 | 9 | | |
| 50417 | 5 | 6 | 10 | 9 | 25.62 | 24.24 | 9 | | |
| 50417 | 6 | 45 | 10 | 9 | 24.68 | 23.6 | 9 | | |
| 50417 | 7 | 4 | 10 | 8 | 24.49 | 23.56 | 8 | | |
| 50417 | 8 | 47 | 10 | 9 | 25.33 | 24.29 | 9 | | |
| 50418 | 1 | 66 | 10 | 10 | 25.27 | 24.15 | 10 | | |
| 50418 | 2 | 69 | 10 | 8 | 23.73 | 22.51 | 8 | | |
| 50418 | 3 | 128 | 10 | 10 | 24.42 | 23.01 | 10 | | |
| 50418 | 4 | 125 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50418 | 5 | 14 | 10 | 10 | 24.4 | 22.85 | 10 | | |
| 50418 | 6 | 76 | 10 | 10 | 25.19 | 23.7 | 10 | | |
| 50418 | 7 | 16 | 10 | 10 | 26.56 | 25.47 | 10 | | |
| 50418 | 8 | 108 | 10 | 9 | 25.08 | 23.68 | 9 | | |
| 50419 | 1 | 71 | 10 | 10 | 24.88 | 23.47 | 10 | | |
| 50419 | 2 | 122 | 10 | 10 | 24.25 | 23.02 | 10 | | |
| 50419 | 3 | 42 | 10 | 10 | 24.8 | 23.56 | 10 | | |
| 50419 | 4 | 32 | 10 | 10 | 23.27 | 21.91 | 10 | | |
| 50419 | 5 | 84 | 10 | 10 | 24.23 | 23.2 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 41 | 10 | 10 | 24.88 | 23.39 | 10 | | |
| 50419 | 7 | 61 | 10 | 9 | 24.97 | 23.63 | 9 | | |
| 50419 | 8 | 92 | 10 | 10 | 24.04 | 22.5 | 10 | | |
| 50420 | 1 | 53 | 10 | 9 | 24.29 | 22.72 | 9 | | |
| 50420 | 2 | 97 | 10 | 9 | 24.81 | 23.78 | 9 | | |
| 50420 | 3 | 9 | 10 | 10 | 25.35 | 23.9 | 10 | | |
| 50420 | 4 | 49 | 10 | 10 | 23.78 | 22.45 | 10 | | |
| 50420 | 5 | 87 | 10 | 10 | 24.63 | 23.14 | 10 | | |
| 50420 | 6 | 21 | 10 | 10 | 26.24 | 24.51 | 10 | | |
| 50420 | 7 | 62 | 10 | 9 | 22.9 | 21.68 | 9 | | |
| 50420 | 8 | 7 | 11 | 11 | 27.94 | 26.21 | 11 | | |
| 50421 | 1 | 113 | 10 | 10 | 23.94 | 22.71 | 10 | | |
| 50421 | 2 | 52 | 10 | 10 | 24.16 | 22.97 | 10 | | |
| 50421 | 3 | 121 | 10 | 8 | 23.59 | 22.58 | 8 | | |
| 50421 | 4 | 103 | 10 | 7 | 26.01 | 24.81 | 7 | | |
| 50421 | 5 | 3 | 10 | 10 | 24.91 | 23.5 | 10 | | |
| 50421 | 6 | 19 | 10 | 10 | 24.23 | 22.97 | 10 | | |
| 50421 | 7 | 86 | 10 | 10 | 25.57 | 24.43 | 10 | | |
| 50421 | 8 | 22 | 10 | 10 | 25.11 | 23.79 | 10 | | |
| 50422 | 1 | 5 | 10 | 9 | 23.17 | 22.2 | 9 | | |
| 50422 | 2 | 31 | 10 | 10 | 25.72 | 24.25 | 10 | | |
| 50422 | 3 | 111 | 10 | 7 | 24.59 | 23.05 | 7 | | |
| 50422 | 4 | 58 | 10 | 10 | 24.1 | 22.82 | 10 | | |
| 50422 | 5 | 11 | 10 | 10 | 26.46 | 24.8 | 10 | | |
| 50422 | 6 | 119 | 10 | 9 | 24.75 | 23.55 | 9 | | |
| 50422 | 7 | 56 | 10 | 10 | 24.48 | 22.83 | 10 | | |
| 50422 | 8 | 94 | 10 | 10 | 24.69 | 23.48 | 10 | | |
| 50423 | 1 | 72 | 10 | 9 | 23.64 | 22.67 | 8 | | |
| 50423 | 2 | 95 | 10 | 9 | 25.33 | 24.19 | 9 | | |
| 50423 | 3 | 109 | 11 | 11 | 24.46 | 23.47 | 11 | | |
| 50423 | 4 | 104 | 10 | 9 | 25.27 | 23.76 | 9 | | |
| 50423 | 5 | 17 | 10 | 10 | 25.38 | 23.91 | 10 | | |
| 50423 | 6 | 40 | 10 | 10 | 22.79 | 21.63 | 10 | | |
| 50423 | 7 | 33 | 10 | 9 | 23.8 | 22.44 | 9 | | |
| 50423 | 8 | 54 | 10 | 10 | 24.53 | 23.28 | 10 | | |
| 50424 | 1 | 35 | 10 | 9 | 23.04 | 21.9 | 9 | | |
| 50424 | 2 | 77 | 10 | 10 | 23.67 | 22.04 | 10 | | |
| 50424 | 3 | 55 | 10 | 10 | 23.34 | 22.24 | 10 | | |
| 50424 | 4 | 82 | 10 | 10 | 24.56 | 23.12 | 10 | | |
| 50424 | 5 | 63 | 10 | 10 | 24.84 | 23.27 | 10 | | |
| 50424 | 6 | 115 | 10 | 9 | 23.87 | 22.86 | 9 | | |
| 50424 | 7 | 114 | 10 | 10 | 24.69 | 23.19 | 10 | | |
| 50424 | 8 | 93 | 10 | 9 | 24.05 | 22.88 | 9 | | |
| 50425 | 1 | 102 | 10 | 8 | 24.5 | 23.17 | 8 | | |
| 50425 | 2 | 91 | 10 | 10 | 23.31 | 21.76 | 10 | | |
| 50425 | 3 | 51 | 10 | 10 | 24.12 | 22.73 | 10 | | |
| 50425 | 4 | 73 | 10 | 10 | 23.22 | 21.63 | 10 | | |
| 50425 | 5 | 68 | 10 | 10 | 25.86 | 24.63 | 10 | | |
| 50425 | 6 | 20 | 10 | 9 | 23.13 | 22.91 | 9 | | |
| 50425 | 7 | 110 | 10 | 9 | 25.38 | 23.97 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 28 | 10 | 9 | 26.9 | 24.4 | 9 | | |
| 50426 | 1 | 2 | 10 | 9 | 25.12 | 23.93 | 9 | | |
| 50426 | 2 | 29 | 10 | 9 | 24.84 | 23.47 | 9 | | |
| 50426 | 3 | 60 | 10 | 10 | 25.04 | 23.82 | 10 | | |
| 50426 | 4 | 126 | 10 | 9 | 25.87 | 24.56 | 9 | | |
| 50426 | 5 | 105 | 10 | 9 | 23.83 | 22.39 | 9 | | |
| 50426 | 6 | 50 | 10 | 10 | 24.8 | 23.15 | 10 | | |
| 50426 | 7 | 74 | 10 | 10 | 24.74 | 22.93 | 10 | | |
| 50426 | 8 | 112 | 10 | 10 | 23.83 | 22.43 | 10 | | |
| 50427 | 1 | 18 | 10 | 10 | 24.83 | 23.55 | 10 | | |
| 50427 | 2 | 13 | 10 | 10 | 25.06 | 23.87 | 10 | | |
| 50427 | 3 | 106 | 10 | 10 | 23.27 | 21.7 | 10 | | |
| 50427 | 4 | 43 | 10 | 10 | 24.39 | 23.28 | 10 | | |
| 50427 | 5 | 38 | 10 | 10 | 24.48 | 23.3 | 10 | | |
| 50427 | 6 | 118 | 10 | 10 | 24.11 | 22.72 | 10 | | |
| 50427 | 7 | 24 | 10 | 9 | 25.14 | 23.69 | 9 | | |
| 50427 | 8 | 101 | 10 | 10 | 24.12 | 22.94 | 10 | | |
| 50428 | 1 | 75 | 10 | 10 | 24.98 | 23.79 | 9 | | |
| 50428 | 2 | 15 | 10 | 10 | 26.1 | 24.21 | 10 | | |
| 50428 | 3 | 26 | 10 | 10 | 24.77 | 23.52 | 9 | | |
| 50428 | 4 | 10 | 10 | 9 | 23.63 | 22.42 | 9 | | |
| 50428 | 5 | 88 | 10 | 9 | 24.89 | 23.59 | 9 | | |
| 50428 | 6 | 46 | 10 | 10 | 25.09 | 23.64 | 9 | | |
| 50428 | 7 | 117 | 10 | 10 | 23.04 | 21.59 | 10 | | |
| 50428 | 8 | 48 | 10 | 7 | 25.46 | 24.66 | 7 | | |
| 50429 | 1 | 64 | 10 | 10 | 23.63 | 22.31 | 10 | | |
| 50429 | 2 | 23 | 10 | 10 | 29.23 | 27.73 | 10 | | |
| 50429 | 3 | 85 | 10 | 10 | 25.02 | 23.43 | 10 | | |
| 50429 | 4 | 27 | 10 | 9 | 24.91 | 23.68 | 8 | | |
| 50429 | 5 | 89 | 10 | 9 | 25.29 | 23.82 | 9 | | |
| 50429 | 6 | 37 | 10 | 9 | 25.27 | 24.11 | 9 | | |
| 50429 | 7 | 116 | 10 | 10 | 22.75 | 21.8 | 10 | | |
| 50429 | 8 | 70 | 10 | 10 | 24.32 | 22.72 | 10 | | |

*Hyalella azteca*

10-day survival and

growth test (dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1700N

(Aquatec Sample # 50431)

STATISTICAL COMPARISONS TO 50431
(SED RACK 1700N)

## CETIS Summary Report

Report Date: 02 Sep-17 14:52 (p 1 of 2)
Test Code: 80612 (C) | 02-6154-7706

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 00-8077-4874 | **Test Type:** | Survival-Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 28 Jul-17 14:40 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 07 Aug-17 16:30 | **Species:** | Hyalella azteca | **Brine:** | |
| **Duration:** | 10d 2h | **Source:** | Aquatic Biosystems, CO | **Age:** | 12d |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 12-5831-4064 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2352 | 50415 passed mean dry weight-mg |
| 06-5288-3801 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1627 | 50416 passed mean dry weight-mg |
| 14-9226-8276 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0334 | 50417 failed mean dry weight-mg |
| 07-9504-3401 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2073 | 50418 passed mean dry weight-mg |
| 16-8707-5303 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1088 | 50419 passed mean dry weight-mg |
| 12-6580-7672 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.4219 | 50420 passed mean dry weight-mg |
| 00-8368-6324 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0626 | 50421 passed mean dry weight-mg |
| 04-4098-0457 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.4605 | 50422 passed mean dry weight-mg |
| 07-8801-6162 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0733 | 50423 passed mean dry weight-mg |
| 02-4557-9259 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1352 | 50424 passed mean dry weight-mg |
| 05-4464-2850 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.5007 | 50425 passed mean dry weight-mg |
| 00-1483-6685 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.4883 | 50426 passed mean dry weight-mg |
| 11-5709-2944 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0639 | 50427 passed mean dry weight-mg |
| 19-0655-8593 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.3396 | 50428 passed mean dry weight-mg |
| 12-0045-7882 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2823 | 50429 passed mean dry weight-mg |
| 05-6712-8372 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50415 passed survival rate |
| 04-8379-3012 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7154 | 50416 passed survival rate |
| 21-2869-1039 | Survival Rate | Equal Variance t Two-Sample Test | 0.0533 | 50417 passed survival rate |
| 11-8619-7382 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.6436 | 50418 passed survival rate |
| 16-1584-5261 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9000 | 50419 passed survival rate |
| 07-8554-8862 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50420 passed survival rate |
| 11-6066-9538 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.4282 | 50421 passed survival rate |
| 04-9188-7632 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50422 passed survival rate |
| 16-2363-4412 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3042 | 50423 passed survival rate |
| 03-0407-9455 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50424 passed survival rate |
| 12-7430-9450 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.2879 | 50425 passed survival rate |
| 18-3615-8905 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3042 | 50426 passed survival rate |
| 11-8941-5454 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9000 | 50427 passed survival rate |
| 05-3459-9958 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50428 passed survival rate |
| 05-0662-8401 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50429 passed survival rate |

### Mean Dry Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 8 | 0.1501 | 0.1279 | 0.1723 | 0.1137 | 0.188 | 0.009391 | 0.02656 | 17.70% | 0.00% |
| 50415 | | 8 | 0.1415 | 0.1253 | 0.1577 | 0.124 | 0.184 | 0.006843 | 0.01935 | 13.68% | 5.74% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | 0.116 | 0.159 | 0.00553 | 0.01564 | 11.25% | 7.40% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.093 | 0.1533 | 0.00692 | 0.01957 | 15.42% | 15.45% |
| 50418 | | 8 | 0.1404 | 0.1245 | 0.1563 | 0.109 | 0.1556 | 0.006722 | 0.01901 | 13.54% | 6.47% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | 0.1144 | 0.154 | 0.005108 | 0.01445 | 10.60% | 9.20% |
| 50420 | | 8 | 0.1477 | 0.1306 | 0.1648 | 0.1144 | 0.1744 | 0.007228 | 0.02044 | 13.84% | 1.59% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | 0.114 | 0.1714 | 0.006377 | 0.01804 | 13.71% | 12.33% |
| 50422 | | 8 | 0.1485 | 0.1189 | 0.1781 | 0.1078 | 0.22 | 0.01251 | 0.03537 | 23.82% | 1.05% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | 0.09 | 0.1678 | 0.008523 | 0.02411 | 18.46% | 12.99% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | 0.11 | 0.163 | 0.00706 | 0.01997 | 14.62% | 8.98% |
| 50425 | | 8 | 0.1501 | 0.09243 | 0.2079 | 0.02444 | 0.2778 | 0.02441 | 0.06903 | 45.98% | -0.03% |
| 50426 | | 8 | 0.1498 | 0.1339 | 0.1656 | 0.122 | 0.181 | 0.006695 | 0.01894 | 12.65% | 0.23% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | 0.111 | 0.1611 | 0.00673 | 0.01904 | 14.49% | 12.46% |
| 50428 | | 8 | 0.1449 | 0.1264 | 0.1635 | 0.1143 | 0.189 | 0.00785 | 0.0222 | 15.32% | 3.44% |
| 50429 | | 8 | 0.1427 | 0.1234 | 0.1621 | 0.095 | 0.1633 | 0.008179 | 0.02314 | 16.21% | 4.90% |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | 0.00% |
| 50415 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 0.00% |
| 50416 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | -1.30% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | 6.49% |
| 50418 | | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | 0.00% |
| 50419 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -2.60% |
| 50420 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 0.00% |
| 50421 | | 8 | 0.9375 | 0.8382 | 1.0000 | 0.7000 | 1.0000 | 0.0420 | 0.1188 | 12.67% | 2.60% |
| 50422 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 2.60% |
| 50423 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 1.30% |
| 50424 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 0.00% |
| 50425 | | 8 | 0.9375 | 0.8753 | 0.9997 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.94% | 2.60% |
| 50426 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 1.30% |
| 50427 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -2.60% |
| 50428 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 2.60% |
| 50429 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 0.00% |

## CETIS Analytical Report

| | |
|---|---|
| **Report Date:** | 02 Sep-17 14:53 (p 1 of 1) |
| **Test Code:** | 80612 (C) \| 02-6154-7706 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 14-9226-8276 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:51 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50431 | 12-3900-0842 | 12 Jun-17 12:00 | 15 Jun-17 16:35 | 46d 3h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 51d 2h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50431 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1700N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean dry weight-mg | 13.69% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 1.988 | 1.761 | 0.021 | 14 | CDF | 0.0334 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0021506 | 0.0021506 | 1 | 3.951 | 0.0668 | Non-Significant Effect |
| Error | 0.0076208 | 0.0005443 | 14 | | | |
| Total | 0.0097714 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.842 | 8.885 | 0.4390 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9671 | 0.8408 | 0.7889 | Normal Distribution |

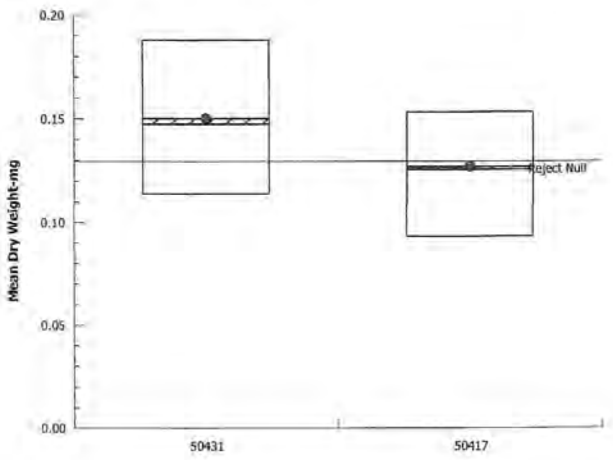
### Mean Dry Weight-mg Summary

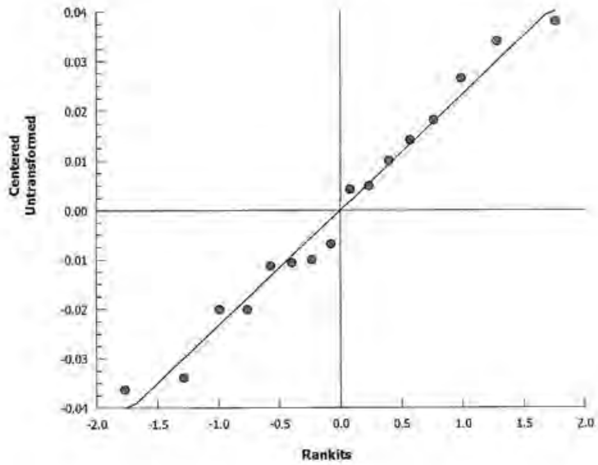
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 8 | 0.1501 | 0.1279 | 0.1723 | 0.1475 | 0.1137 | 0.188 | 0.009391 | 17.70% | 0.00% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.1256 | 0.093 | 0.1533 | 0.00692 | 15.42% | 15.45% |

### Mean Dry Weight-mg Detail

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50431 | RS | 0.13 | 0.155 | 0.13 | 0.16 | 0.14 | 0.184 | 0.188 | 0.1137 |
| 50417 | | 0.093 | 0.141 | 0.145 | 0.1311 | 0.1533 | 0.12 | 0.1163 | 0.1156 |

### Graphics






Analyst: JW QA: 9/9/17

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

**Start Date:** 28 Jul-17 14:40 **Species:** Hyalella azteca **Sample Code:** 50431
**End Date:** 07 Aug-17 16:30 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** PEPCO Benning Rd-Waterside Inve
**Sample Date:** 12 Jun-17 12:00 **Material:** Reference sediment **Sample Station:** SEDBACK1700N

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50431 | 1 | 42 | 10 | 9 | 24.79 | 23.62 | 9 | | |
| 50431 | 2 | 106 | 10 | 10 | 28.14 | 26.59 | 10 | | |
| 50431 | 3 | 127 | 10 | 10 | 24.86 | 23.56 | 10 | | |
| 50431 | 4 | 56 | 10 | 10 | 25.87 | 24.27 | 10 | | |
| 50431 | 5 | 68 | 10 | 10 | 25.16 | 23.76 | 10 | | |
| 50431 | 6 | 123 | 10 | 10 | 25.59 | 23.75 | 10 | | |
| 50431 | 7 | 77 | 10 | 10 | 26.32 | 24.44 | 10 | | |
| 50431 | 8 | 104 | 10 | 8 | 26.21 | 25.3 | 8 | | |
| 50415 | 1 | 107 | 10 | 9 | 23.34 | 22.02 | 9 | | |
| 50415 | 2 | 49 | 10 | 10 | 26.1 | 24.26 | 10 | | |
| 50415 | 3 | 27 | 10 | 10 | 25.07 | 23.65 | 10 | | |
| 50415 | 4 | 7 | 10 | 10 | 25.77 | 24.48 | 10 | | |
| 50415 | 5 | 90 | 10 | 9 | 23.64 | 22.52 | 9 | | |
| 50415 | 6 | 45 | 10 | 10 | 24.4 | 23.16 | 10 | | |
| 50415 | 7 | 13 | 10 | 9 | 26.58 | 25.35 | 9 | | |
| 50415 | 8 | 36 | 10 | 10 | 25.06 | 23.61 | 10 | | |
| 50416 | 1 | 15 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50416 | 2 | 88 | 10 | 9 | 24.87 | 23.74 | 9 | | |
| 50416 | 3 | 5 | 10 | 10 | 24.82 | 23.66 | 10 | | |
| 50416 | 4 | 38 | 10 | 10 | 24.62 | 23.03 | 10 | | |
| 50416 | 5 | 16 | 10 | 10 | 25.24 | 23.89 | 10 | | |
| 50416 | 6 | 126 | 10 | 9 | 23.17 | 21.88 | 9 | | |
| 50416 | 7 | 61 | 10 | 10 | 25.3 | 24.03 | 10 | | |
| 50416 | 8 | 62 | 10 | 10 | 25.07 | 23.5 | 10 | | |
| 50417 | 1 | 25 | 10 | 10 | 26.02 | 25.09 | 10 | | |
| 50417 | 2 | 53 | 10 | 10 | 25.21 | 23.8 | 10 | | |
| 50417 | 3 | 9 | 10 | 8 | 24.97 | 23.81 | 8 | | |
| 50417 | 4 | 74 | 10 | 9 | 24.18 | 23 | 9 | | |
| 50417 | 5 | 55 | 10 | 9 | 25.62 | 24.24 | 9 | | |
| 50417 | 6 | 47 | 10 | 9 | 24.68 | 23.6 | 9 | | |
| 50417 | 7 | 33 | 10 | 8 | 24.49 | 23.56 | 8 | | |
| 50417 | 8 | 108 | 10 | 9 | 25.33 | 24.29 | 9 | | |
| 50418 | 1 | 125 | 10 | 10 | 25.27 | 24.15 | 10 | | |
| 50418 | 2 | 99 | 10 | 8 | 23.73 | 22.51 | 8 | | |
| 50418 | 3 | 98 | 10 | 10 | 24.42 | 23.01 | 10 | | |
| 50418 | 4 | 87 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50418 | 5 | 30 | 10 | 10 | 24.4 | 22.85 | 10 | | |
| 50418 | 6 | 122 | 10 | 10 | 25.19 | 23.7 | 10 | | |
| 50418 | 7 | 28 | 10 | 10 | 26.56 | 25.47 | 10 | | |
| 50418 | 8 | 20 | 10 | 9 | 25.08 | 23.68 | 9 | | |
| 50419 | 1 | 103 | 10 | 10 | 24.88 | 23.47 | 10 | | |
| 50419 | 2 | 48 | 10 | 10 | 24.25 | 23.02 | 10 | | |
| 50419 | 3 | 46 | 10 | 10 | 24.8 | 23.56 | 10 | | |
| 50419 | 4 | 71 | 10 | 10 | 23.27 | 21.91 | 10 | | |
| 50419 | 5 | 80 | 10 | 10 | 24.23 | 23.2 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 18 | 10 | 10 | 24.88 | 23.39 | 10 | | |
| 50419 | 7 | 101 | 10 | 9 | 24.97 | 23.63 | 9 | | |
| 50419 | 8 | 3 | 10 | 10 | 24.04 | 22.5 | 10 | | |
| 50420 | 1 | 115 | 10 | 9 | 24.29 | 22.72 | 9 | | |
| 50420 | 2 | 111 | 10 | 9 | 24.81 | 23.78 | 9 | | |
| 50420 | 3 | 83 | 10 | 10 | 25.35 | 23.9 | 10 | | |
| 50420 | 4 | 35 | 10 | 10 | 23.78 | 22.45 | 10 | | |
| 50420 | 5 | 113 | 10 | 10 | 24.63 | 23.14 | 10 | | |
| 50420 | 6 | 24 | 10 | 10 | 26.24 | 24.51 | 10 | | |
| 50420 | 7 | 114 | 10 | 9 | 22.9 | 21.68 | 9 | | |
| 50420 | 8 | 4 | 11 | 11 | 27.94 | 26.21 | 11 | | |
| 50421 | 1 | 2 | 10 | 10 | 23.94 | 22.71 | 10 | | |
| 50421 | 2 | 17 | 10 | 10 | 24.16 | 22.97 | 10 | | |
| 50421 | 3 | 118 | 10 | 8 | 23.59 | 22.58 | 8 | | |
| 50421 | 4 | 54 | 10 | 7 | 26.01 | 24.81 | 7 | | |
| 50421 | 5 | 14 | 10 | 10 | 24.91 | 23.5 | 10 | | |
| 50421 | 6 | 1 | 10 | 10 | 24.23 | 22.97 | 10 | | |
| 50421 | 7 | 19 | 10 | 10 | 25.57 | 24.43 | 10 | | |
| 50421 | 8 | 117 | 10 | 10 | 25.11 | 23.79 | 10 | | |
| 50422 | 1 | 26 | 10 | 9 | 23.17 | 22.2 | 9 | | |
| 50422 | 2 | 105 | 10 | 10 | 25.72 | 24.25 | 10 | | |
| 50422 | 3 | 31 | 10 | 7 | 24.59 | 23.05 | 7 | | |
| 50422 | 4 | 43 | 10 | 10 | 24.1 | 22.82 | 10 | | |
| 50422 | 5 | 91 | 10 | 10 | 26.46 | 24.8 | 10 | | |
| 50422 | 6 | 34 | 10 | 9 | 24.75 | 23.55 | 9 | | |
| 50422 | 7 | 102 | 10 | 10 | 24.48 | 22.83 | 10 | | |
| 50422 | 8 | 50 | 10 | 10 | 24.69 | 23.48 | 10 | | |
| 50423 | 1 | 97 | 10 | 9 | 23.64 | 22.67 | 8 | | |
| 50423 | 2 | 11 | 10 | 9 | 25.33 | 24.19 | 9 | | |
| 50423 | 3 | 119 | 11 | 11 | 24.46 | 23.47 | 11 | | |
| 50423 | 4 | 21 | 10 | 9 | 25.27 | 23.76 | 9 | | |
| 50423 | 5 | 75 | 10 | 10 | 25.38 | 23.91 | 10 | | |
| 50423 | 6 | 37 | 10 | 10 | 22.79 | 21.63 | 10 | | |
| 50423 | 7 | 23 | 10 | 9 | 23.8 | 22.44 | 9 | | |
| 50423 | 8 | 109 | 10 | 10 | 24.53 | 23.28 | 10 | | |
| 50424 | 1 | 40 | 10 | 9 | 23.04 | 21.9 | 9 | | |
| 50424 | 2 | 52 | 10 | 10 | 23.67 | 22.04 | 10 | | |
| 50424 | 3 | 39 | 10 | 10 | 23.34 | 22.24 | 10 | | |
| 50424 | 4 | 100 | 10 | 10 | 24.56 | 23.12 | 10 | | |
| 50424 | 5 | 10 | 10 | 10 | 24.84 | 23.27 | 10 | | |
| 50424 | 6 | 110 | 10 | 9 | 23.87 | 22.86 | 9 | | |
| 50424 | 7 | 120 | 10 | 10 | 24.69 | 23.19 | 10 | | |
| 50424 | 8 | 94 | 10 | 9 | 24.05 | 22.88 | 9 | | |
| 50425 | 1 | 92 | 10 | 8 | 24.5 | 23.17 | 8 | | |
| 50425 | 2 | 82 | 10 | 10 | 23.31 | 21.76 | 10 | | |
| 50425 | 3 | 72 | 10 | 10 | 24.12 | 22.73 | 10 | | |
| 50425 | 4 | 8 | 10 | 10 | 23.22 | 21.63 | 10 | | |
| 50425 | 5 | 65 | 10 | 10 | 25.86 | 24.63 | 10 | | |
| 50425 | 6 | 116 | 10 | 9 | 23.13 | 22.91 | 9 | | |
| 50425 | 7 | 95 | 10 | 9 | 25.38 | 23.97 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 89 | 10 | 9 | 26.9 | 24.4 | 9 | | |
| 50426 | 1 | 81 | 10 | 9 | 25.12 | 23.93 | 9 | | |
| 50426 | 2 | 22 | 10 | 9 | 24.84 | 23.47 | 9 | | |
| 50426 | 3 | 29 | 10 | 10 | 25.04 | 23.82 | 10 | | |
| 50426 | 4 | 58 | 10 | 9 | 25.87 | 24.56 | 9 | | |
| 50426 | 5 | 93 | 10 | 9 | 23.83 | 22.39 | 9 | | |
| 50426 | 6 | 60 | 10 | 10 | 24.8 | 23.15 | 10 | | |
| 50426 | 7 | 44 | 10 | 10 | 24.74 | 22.93 | 10 | | |
| 50426 | 8 | 59 | 10 | 10 | 23.83 | 22.43 | 10 | | |
| 50427 | 1 | 66 | 10 | 10 | 24.83 | 23.55 | 10 | | |
| 50427 | 2 | 78 | 10 | 10 | 25.06 | 23.87 | 10 | | |
| 50427 | 3 | 32 | 10 | 10 | 23.27 | 21.7 | 10 | | |
| 50427 | 4 | 67 | 10 | 10 | 24.39 | 23.28 | 10 | | |
| 50427 | 5 | 57 | 10 | 10 | 24.48 | 23.3 | 10 | | |
| 50427 | 6 | 86 | 10 | 10 | 24.11 | 22.72 | 10 | | |
| 50427 | 7 | 128 | 10 | 9 | 25.14 | 23.69 | 9 | | |
| 50427 | 8 | 112 | 10 | 10 | 24.12 | 22.94 | 10 | | |
| 50428 | 1 | 79 | 10 | 10 | 24.98 | 23.79 | 9 | | |
| 50428 | 2 | 70 | 10 | 10 | 26.1 | 24.21 | 10 | | |
| 50428 | 3 | 124 | 10 | 10 | 24.77 | 23.52 | 9 | | |
| 50428 | 4 | 69 | 10 | 9 | 23.63 | 22.42 | 9 | | |
| 50428 | 5 | 96 | 10 | 9 | 24.89 | 23.59 | 9 | | |
| 50428 | 6 | 76 | 10 | 10 | 25.09 | 23.64 | 9 | | |
| 50428 | 7 | 121 | 10 | 10 | 23.04 | 21.59 | 10 | | |
| 50428 | 8 | 51 | 10 | 7 | 25.46 | 24.66 | 7 | | |
| 50429 | 1 | 12 | 10 | 10 | 23.63 | 22.31 | 10 | | |
| 50429 | 2 | 84 | 10 | 10 | 29.23 | 27.73 | 10 | | |
| 50429 | 3 | 41 | 10 | 10 | 25.02 | 23.43 | 10 | | |
| 50429 | 4 | 63 | 10 | 9 | 24.91 | 23.68 | 8 | | |
| 50429 | 5 | 73 | 10 | 9 | 25.29 | 23.82 | 9 | | |
| 50429 | 6 | 6 | 10 | 9 | 25.27 | 24.11 | 9 | | |
| 50429 | 7 | 85 | 10 | 10 | 22.75 | 21.8 | 10 | | |
| 50429 | 8 | 64 | 10 | 10 | 24.32 | 22.72 | 10 | | |

*Hyalella azteca*

10-day survival and

growth test (dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1800N

(Aquatec Sample # 50432)

STATISTICAL COMPARISONS TO 50432
(SEDBACK 1800N)

## CETIS Summary Report

Report Date: 02 Sep-17 15:00 (p 1 of 2)
Test Code: 80613 (D) | 04-6809-8154

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 00-8077-4874 | **Test Type:** | Survival-Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 28 Jul-17 14:40 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 07 Aug-17 16:30 | **Species:** | Hyalella azteca | **Brine:** | |
| **Duration:** | 10d 2h | **Source:** | Aquatic Biosystems, CO | **Age:** | 12d |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 12-4318-6722 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.3309 | 50415 passed mean dry weight-mg |
| 16-6832-8058 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2262 | 50416 passed mean dry weight-mg |
| 13-4656-4151 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0366 | 50417 failed mean dry weight-mg |
| 10-2992-3241 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2908 | 50418 passed mean dry weight-mg |
| 01-3003-0978 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1428 | 50419 passed mean dry weight-mg |
| 12-8574-6245 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.5743 | 50420 passed mean dry weight-mg |
| 01-2781-3807 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0759 | 50421 passed mean dry weight-mg |
| 08-3689-1405 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.5737 | 50422 passed mean dry weight-mg |
| 17-4980-0170 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0934 | 50423 passed mean dry weight-mg |
| 07-7158-0319 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1833 | 50424 passed mean dry weight-mg |
| 05-1759-4242 | Mean Dry Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.6008 | 50425 passed mean dry weight-mg |
| 14-2832-0041 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.6561 | 50426 passed mean dry weight-mg |
| 07-9593-8745 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0782 | 50427 passed mean dry weight-mg |
| 20-6053-0077 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.4668 | 50428 passed mean dry weight-mg |
| 10-1669-4069 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.3893 | 50429 passed mean dry weight-mg |
| 12-1452-6092 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50415 passed survival rate |
| 10-1970-1962 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7154 | 50416 passed survival rate |
| 11-3415-5540 | Survival Rate | Equal Variance t Two-Sample Test | 0.0151 | 50417 failed survival rate |
| 04-5354-6080 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50418 passed survival rate |
| 07-6236-3720 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9000 | 50419 passed survival rate |
| 00-3002-6003 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50420 passed survival rate |
| 19-6041-4955 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50421 passed survival rate |
| 21-0399-7930 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50422 passed survival rate |
| 19-6547-5081 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3042 | 50423 passed survival rate |
| 17-7566-4099 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50424 passed survival rate |
| 21-4593-6040 | Survival Rate | Equal Variance t Two-Sample Test | 0.1226 | 50425 passed survival rate |
| 05-0131-0642 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3042 | 50426 passed survival rate |
| 06-6233-8520 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9000 | 50427 passed survival rate |
| 03-6789-3305 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50428 passed survival rate |
| 18-3194-2362 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50429 passed survival rate |

### Mean Dry Weight-mg Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 0.1458 | 0.1295 | 0.1621 | 0.1156 | 0.17 | 0.006884 | 0.01947 | 13.35% | 0.00% |
| 50415 | | 8 | 0.1415 | 0.1253 | 0.1577 | 0.124 | 0.184 | 0.006843 | 0.01935 | 13.68% | 2.98% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | 0.116 | 0.159 | 0.00553 | 0.01564 | 11.25% | 4.68% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.093 | 0.1533 | 0.00692 | 0.01957 | 15.42% | 12.97% |
| 50418 | | 8 | 0.1404 | 0.1245 | 0.1563 | 0.109 | 0.1556 | 0.006722 | 0.01901 | 13.54% | 3.72% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | 0.1144 | 0.154 | 0.005108 | 0.01445 | 10.60% | 6.53% |
| 50420 | | 8 | 0.1477 | 0.1306 | 0.1648 | 0.1144 | 0.1744 | 0.007228 | 0.02044 | 13.84% | -1.31% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | 0.114 | 0.1714 | 0.006377 | 0.01804 | 13.71% | 9.76% |
| 50422 | | 8 | 0.1485 | 0.1189 | 0.1781 | 0.1078 | 0.22 | 0.01251 | 0.03537 | 23.82% | -1.85% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | 0.09 | 0.1678 | 0.008523 | 0.02411 | 18.46% | 10.43% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | 0.11 | 0.163 | 0.00706 | 0.01997 | 14.62% | 6.31% |
| 50425 | | 8 | 0.1501 | 0.09243 | 0.2079 | 0.02444 | 0.2778 | 0.02441 | 0.06903 | 45.98% | -2.97% |
| 50426 | | 8 | 0.1498 | 0.1339 | 0.1656 | 0.122 | 0.181 | 0.006695 | 0.01894 | 12.65% | -2.70% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | 0.111 | 0.1611 | 0.00673 | 0.01904 | 14.49% | 9.89% |
| 50428 | | 8 | 0.1449 | 0.1264 | 0.1635 | 0.1143 | 0.189 | 0.00785 | 0.0222 | 15.32% | 0.61% |
| 50429 | | 8 | 0.1427 | 0.1234 | 0.1621 | 0.095 | 0.1633 | 0.008179 | 0.02314 | 16.21% | 2.10% |

### Survival Rate Summary

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | 0.00% |
| 50415 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |
| 50416 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | 0.00% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | 7.69% |
| 50418 | | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | 1.28% |
| 50419 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -1.28% |
| 50420 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |
| 50421 | | 8 | 0.9375 | 0.8382 | 1.0000 | 0.7000 | 1.0000 | 0.0420 | 0.1188 | 12.67% | 3.85% |
| 50422 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 3.85% |
| 50423 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 2.56% |
| 50424 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |
| 50425 | | 8 | 0.9375 | 0.8753 | 0.9997 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.94% | 3.85% |
| 50426 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 2.56% |
| 50427 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -1.28% |
| 50428 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 3.85% |
| 50429 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 11-3415-5540 | **Endpoint:** | Survival Rate | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:00 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 46d 1h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 51d 2h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Angular (Corrected) | C > T | 50417 failed survival rate | 5.52% |

**Equal Variance t Two-Sample Test**

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Reference Sed | | 50417* | 2.413 | 1.761 | 0.086 | 14 | CDF | 0.0151 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0555926 | 0.0555926 | 1 | 5.823 | 0.0301 | Significant Effect |
| Error | 0.133661 | 0.0095472 | 14 | | | |
| Total | 0.189253 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.301 | 8.885 | 0.2940 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8836 | 0.8408 | 0.0441 | Normal Distribution |

**Survival Rate Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 0.9750 | 0.9363 | 1.0000 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 4.75% | 0.00% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.9000 | 0.8000 | 1.0000 | 0.0267 | 8.40% | 7.69% |

**Angular (Corrected) Transformed Summary**

| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 1.372 | 1.309 | 1.436 | 1.412 | 1.249 | 1.419 | 0.02689 | 5.54% | 0.00% |
| 50417 | | 8 | 1.254 | 1.158 | 1.351 | 1.249 | 1.107 | 1.412 | 0.04079 | 9.20% | 8.59% |

**Survival Rate Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 0.9000 | 0.9000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 50417 | | 1.0000 | 1.0000 | 0.8000 | 0.9000 | 0.9000 | 0.9000 | 0.8000 | 0.9000 |

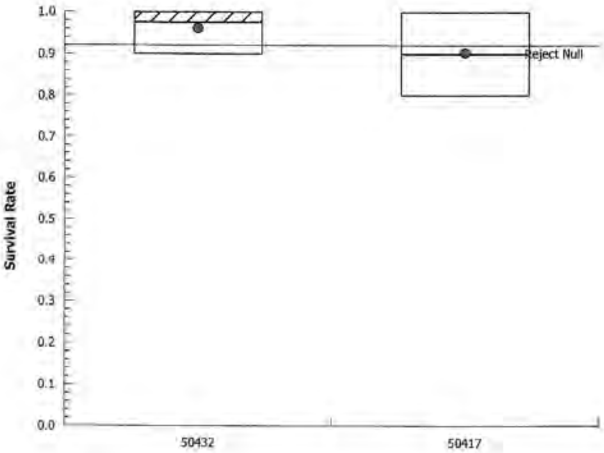
**Angular (Corrected) Transformed Detail**

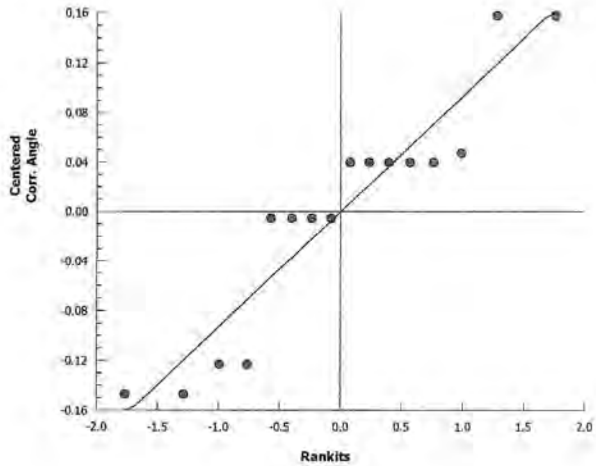
| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 1.249 | 1.249 | 1.412 | 1.412 | 1.412 | 1.412 | 1.412 | 1.419 |
| 50417 | | 1.412 | 1.412 | 1.107 | 1.249 | 1.249 | 1.249 | 1.107 | 1.249 |

**Hyalella 10-d Survival and Growth Sediment Test** | **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 11-3415-5540 | **Endpoint:** | Survival Rate | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:00 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

**Graphics**



# CETIS Analytical Report

Report Date: 02 Sep-17 15:01 (p 1 of 1)
Test Code: 80613 (D) | 04-6809-8154

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 13-4656-4151 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 14:59 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50432 | 00-9239-3049 | 12 Jun-17 13:15 | 15 Jun-17 16:35 | 46d 1h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 51d 2h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50432 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1800N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean dry weight-mg | 11.79% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 1.937 | 1.761 | 0.017 | 14 | CDF | 0.0366 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0014295 | 0.0014295 | 1 | 3.751 | 0.0732 | Non-Significant Effect |
| Error | 0.0053358 | 0.0003811 | 14 | | | |
| Total | 0.0067653 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.01 | 8.885 | 0.9894 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9535 | 0.8408 | 0.5463 | Normal Distribution |

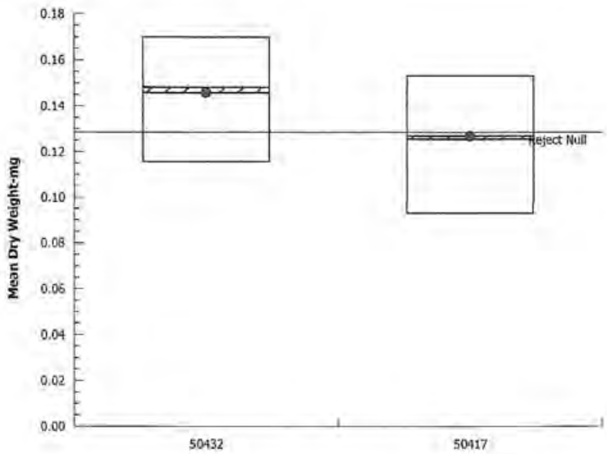
**Mean Dry Weight-mg Summary**

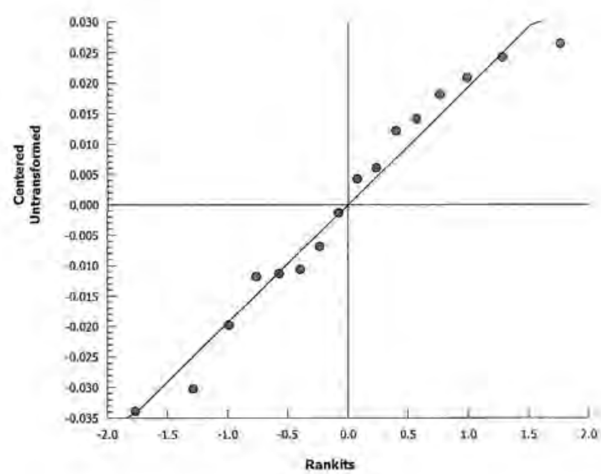
| Sample | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 8 | 0.1458 | 0.1295 | 0.1621 | 0.1481 | 0.1156 | 0.17 | 0.006884 | 13.35% | 0.00% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.1256 | 0.093 | 0.1533 | 0.00692 | 15.42% | 12.97% |

**Mean Dry Weight-mg Detail**

| Sample | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | RS | 0.1444 | 0.1667 | 0.158 | 0.126 | 0.1156 | 0.17 | 0.134 | 0.1518 |
| 50417 | | 0.093 | 0.141 | 0.145 | 0.1311 | 0.1533 | 0.12 | 0.1163 | 0.1156 |

**Graphics**



## CETIS Test Data Worksheet



**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Start Date:** | 28 Jul-17 14:40 | **Species:** | Hyalella azteca | **Sample Code:** | 50432 |
| **End Date:** | 07 Aug-17 16:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Sample Source:** | PEPCO Benning Rd-Waterside Inve |
| **Sample Date:** | 12 Jun-17 13:15 | **Material:** | Reference sediment | **Sample Station:** | SEDBACK1800N |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50432 | 1 | 80 | 10 | 9 | 24.24 | 22.94 | 9 | | |
| 50432 | 2 | 89 | 10 | 9 | 26.74 | 25.24 | 9 | | |
| 50432 | 3 | 102 | 10 | 10 | 25.49 | 23.91 | 10 | | |
| 50432 | 4 | 14 | 10 | 10 | 23.65 | 22.39 | 10 | | |
| 50432 | 5 | 65 | 10 | 10 | 24.84 | 23.8 | 9 | | |
| 50432 | 6 | 127 | 10 | 10 | 24.77 | 23.07 | 10 | | |
| 50432 | 7 | 20 | 10 | 10 | 23.99 | 22.65 | 10 | | |
| 50432 | 8 | 93 | 11 | 11 | 24.81 | 23.14 | 11 | | |
| 50415 | 1 | 10 | 10 | 9 | 23.34 | 22.02 | 9 | | |
| 50415 | 2 | 105 | 10 | 10 | 26.1 | 24.26 | 10 | | |
| 50415 | 3 | 35 | 10 | 10 | 25.07 | 23.65 | 10 | | |
| 50415 | 4 | 32 | 10 | 10 | 25.77 | 24.48 | 10 | | |
| 50415 | 5 | 59 | 10 | 9 | 23.64 | 22.52 | 9 | | |
| 50415 | 6 | 108 | 10 | 10 | 24.4 | 23.16 | 10 | | |
| 50415 | 7 | 109 | 10 | 9 | 26.58 | 25.35 | 9 | | |
| 50415 | 8 | 107 | 10 | 10 | 25.06 | 23.61 | 10 | | |
| 50416 | 1 | 3 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50416 | 2 | 26 | 10 | 9 | 24.87 | 23.74 | 9 | | |
| 50416 | 3 | 126 | 10 | 10 | 24.82 | 23.66 | 10 | | |
| 50416 | 4 | 61 | 10 | 10 | 24.62 | 23.03 | 10 | | |
| 50416 | 5 | 100 | 10 | 10 | 25.24 | 23.89 | 10 | | |
| 50416 | 6 | 54 | 10 | 9 | 23.17 | 21.88 | 9 | | |
| 50416 | 7 | 41 | 10 | 10 | 25.3 | 24.03 | 10 | | |
| 50416 | 8 | 62 | 10 | 10 | 25.07 | 23.5 | 10 | | |
| 50417 | 1 | 1 | 10 | 10 | 26.02 | 25.09 | 10 | | |
| 50417 | 2 | 36 | 10 | 10 | 25.21 | 23.8 | 10 | | |
| 50417 | 3 | 71 | 10 | 8 | 24.97 | 23.81 | 8 | | |
| 50417 | 4 | 119 | 10 | 9 | 24.18 | 23 | 9 | | |
| 50417 | 5 | 30 | 10 | 9 | 25.62 | 24.24 | 9 | | |
| 50417 | 6 | 110 | 10 | 9 | 24.68 | 23.6 | 9 | | |
| 50417 | 7 | 64 | 10 | 8 | 24.49 | 23.56 | 8 | | |
| 50417 | 8 | 115 | 10 | 9 | 25.33 | 24.29 | 9 | | |
| 50418 | 1 | 66 | 10 | 10 | 25.27 | 24.15 | 10 | | |
| 50418 | 2 | 51 | 10 | 8 | 23.73 | 22.51 | 8 | | |
| 50418 | 3 | 87 | 10 | 10 | 24.42 | 23.01 | 10 | | |
| 50418 | 4 | 19 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50418 | 5 | 76 | 10 | 10 | 24.4 | 22.85 | 10 | | |
| 50418 | 6 | 55 | 10 | 10 | 25.19 | 23.7 | 10 | | |
| 50418 | 7 | 27 | 10 | 10 | 26.56 | 25.47 | 10 | | |
| 50418 | 8 | 42 | 10 | 9 | 25.08 | 23.68 | 9 | | |
| 50419 | 1 | 13 | 10 | 10 | 24.88 | 23.47 | 10 | | |
| 50419 | 2 | 50 | 10 | 10 | 24.25 | 23.02 | 10 | | |
| 50419 | 3 | 72 | 10 | 10 | 24.8 | 23.56 | 10 | | |
| 50419 | 4 | 67 | 10 | 10 | 23.27 | 21.91 | 10 | | |
| 50419 | 5 | 46 | 10 | 10 | 24.23 | 23.2 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 2 | 10 | 10 | 24.88 | 23.39 | 10 | | |
| 50419 | 7 | 33 | 10 | 9 | 24.97 | 23.63 | 9 | | |
| 50419 | 8 | 123 | 10 | 10 | 24.04 | 22.5 | 10 | | |
| 50420 | 1 | 95 | 10 | 9 | 24.29 | 22.72 | 9 | | |
| 50420 | 2 | 58 | 10 | 9 | 24.81 | 23.78 | 9 | | |
| 50420 | 3 | 103 | 10 | 10 | 25.35 | 23.9 | 10 | | |
| 50420 | 4 | 34 | 10 | 10 | 23.78 | 22.45 | 10 | | |
| 50420 | 5 | 125 | 10 | 10 | 24.63 | 23.14 | 10 | | |
| 50420 | 6 | 9 | 10 | 10 | 26.24 | 24.51 | 10 | | |
| 50420 | 7 | 4 | 10 | 9 | 22.9 | 21.68 | 9 | | |
| 50420 | 8 | 112 | 11 | 11 | 27.94 | 26.21 | 11 | | |
| 50421 | 1 | 77 | 10 | 10 | 23.94 | 22.71 | 10 | | |
| 50421 | 2 | 122 | 10 | 10 | 24.16 | 22.97 | 10 | | |
| 50421 | 3 | 106 | 10 | 8 | 23.59 | 22.58 | 8 | | |
| 50421 | 4 | 44 | 10 | 7 | 26.01 | 24.81 | 7 | | |
| 50421 | 5 | 68 | 10 | 10 | 24.91 | 23.5 | 10 | | |
| 50421 | 6 | 85 | 10 | 10 | 24.23 | 22.97 | 10 | | |
| 50421 | 7 | 128 | 10 | 10 | 25.57 | 24.43 | 10 | | |
| 50421 | 8 | 16 | 10 | 10 | 25.11 | 23.79 | 10 | | |
| 50422 | 1 | 118 | 10 | 9 | 23.17 | 22.2 | 9 | | |
| 50422 | 2 | 113 | 10 | 10 | 25.72 | 24.25 | 10 | | |
| 50422 | 3 | 70 | 10 | 7 | 24.59 | 23.05 | 7 | | |
| 50422 | 4 | 75 | 10 | 10 | 24.1 | 22.82 | 10 | | |
| 50422 | 5 | 15 | 10 | 10 | 26.46 | 24.8 | 10 | | |
| 50422 | 6 | 92 | 10 | 9 | 24.75 | 23.55 | 9 | | |
| 50422 | 7 | 98 | 10 | 10 | 24.48 | 22.83 | 10 | | |
| 50422 | 8 | 79 | 10 | 10 | 24.69 | 23.48 | 10 | | |
| 50423 | 1 | 38 | 10 | 9 | 23.64 | 22.67 | 8 | | |
| 50423 | 2 | 101 | 10 | 9 | 25.33 | 24.19 | 9 | | |
| 50423 | 3 | 8 | 11 | 11 | 24.46 | 23.47 | 11 | | |
| 50423 | 4 | 63 | 10 | 9 | 25.27 | 23.76 | 9 | | |
| 50423 | 5 | 6 | 10 | 10 | 25.38 | 23.91 | 10 | | |
| 50423 | 6 | 37 | 10 | 10 | 22.79 | 21.63 | 10 | | |
| 50423 | 7 | 11 | 10 | 9 | 23.8 | 22.44 | 9 | | |
| 50423 | 8 | 60 | 10 | 10 | 24.53 | 23.28 | 10 | | |
| 50424 | 1 | 94 | 10 | 9 | 23.04 | 21.9 | 9 | | |
| 50424 | 2 | 114 | 10 | 10 | 23.67 | 22.04 | 10 | | |
| 50424 | 3 | 48 | 10 | 10 | 23.34 | 22.24 | 10 | | |
| 50424 | 4 | 29 | 10 | 10 | 24.56 | 23.12 | 10 | | |
| 50424 | 5 | 99 | 10 | 10 | 24.84 | 23.27 | 10 | | |
| 50424 | 6 | 74 | 10 | 9 | 23.87 | 22.86 | 9 | | |
| 50424 | 7 | 86 | 10 | 10 | 24.69 | 23.19 | 10 | | |
| 50424 | 8 | 22 | 10 | 9 | 24.05 | 22.88 | 9 | | |
| 50425 | 1 | 97 | 10 | 8 | 24.5 | 23.17 | 8 | | |
| 50425 | 2 | 69 | 10 | 10 | 23.31 | 21.76 | 10 | | |
| 50425 | 3 | 57 | 10 | 10 | 24.12 | 22.73 | 10 | | |
| 50425 | 4 | 23 | 10 | 10 | 23.22 | 21.63 | 10 | | |
| 50425 | 5 | 25 | 10 | 10 | 25.86 | 24.63 | 10 | | |
| 50425 | 6 | 82 | 10 | 9 | 23.13 | 22.91 | 9 | | |
| 50425 | 7 | 120 | 10 | 9 | 25.38 | 23.97 | 9 | | |



Analyst: JV QA: 9/9/17

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 81 | 10 | 9 | 26.9 | 24.4 | 9 | | |
| 50426 | 1 | 78 | 10 | 9 | 25.12 | 23.93 | 9 | | |
| 50426 | 2 | 7 | 10 | 9 | 24.84 | 23.47 | 9 | | |
| 50426 | 3 | 31 | 10 | 10 | 25.04 | 23.82 | 10 | | |
| 50426 | 4 | 117 | 10 | 9 | 25.87 | 24.56 | 9 | | |
| 50426 | 5 | 83 | 10 | 9 | 23.83 | 22.39 | 9 | | |
| 50426 | 6 | 12 | 10 | 10 | 24.8 | 23.15 | 10 | | |
| 50426 | 7 | 116 | 10 | 10 | 24.74 | 22.93 | 10 | | |
| 50426 | 8 | 111 | 10 | 10 | 23.83 | 22.43 | 10 | | |
| 50427 | 1 | 47 | 10 | 10 | 24.83 | 23.55 | 10 | | |
| 50427 | 2 | 45 | 10 | 10 | 25.06 | 23.87 | 10 | | |
| 50427 | 3 | 124 | 10 | 10 | 23.27 | 21.7 | 10 | | |
| 50427 | 4 | 17 | 10 | 10 | 24.39 | 23.28 | 10 | | |
| 50427 | 5 | 53 | 10 | 10 | 24.48 | 23.3 | 10 | | |
| 50427 | 6 | 24 | 10 | 10 | 24.11 | 22.72 | 10 | | |
| 50427 | 7 | 28 | 10 | 9 | 25.14 | 23.69 | 9 | | |
| 50427 | 8 | 49 | 10 | 10 | 24.12 | 22.94 | 10 | | |
| 50428 | 1 | 96 | 10 | 10 | 24.98 | 23.79 | 9 | | |
| 50428 | 2 | 88 | 10 | 10 | 26.1 | 24.21 | 10 | | |
| 50428 | 3 | 21 | 10 | 10 | 24.77 | 23.52 | 9 | | |
| 50428 | 4 | 5 | 10 | 9 | 23.63 | 22.42 | 9 | | |
| 50428 | 5 | 52 | 10 | 9 | 24.89 | 23.59 | 9 | | |
| 50428 | 6 | 121 | 10 | 10 | 25.09 | 23.64 | 9 | | |
| 50428 | 7 | 91 | 10 | 10 | 23.04 | 21.59 | 10 | | |
| 50428 | 8 | 56 | 10 | 7 | 25.46 | 24.66 | 7 | | |
| 50429 | 1 | 104 | 10 | 10 | 23.63 | 22.31 | 10 | | |
| 50429 | 2 | 43 | 10 | 10 | 29.23 | 27.73 | 10 | | |
| 50429 | 3 | 84 | 10 | 10 | 25.02 | 23.43 | 10 | | |
| 50429 | 4 | 40 | 10 | 9 | 24.91 | 23.68 | 8 | | |
| 50429 | 5 | 73 | 10 | 9 | 25.29 | 23.82 | 9 | | |
| 50429 | 6 | 39 | 10 | 9 | 25.27 | 24.11 | 9 | | |
| 50429 | 7 | 18 | 10 | 10 | 22.75 | 21.8 | 10 | | |
| 50429 | 8 | 90 | 10 | 10 | 24.32 | 22.72 | 10 | | |

*Hyalella azteca*

10-day survival and

growth test (dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK1900N

(Aquatec Sample # 50433)

STATISTICAL COMPARISONS TO 50433
(SED BACK 1900N)

## CETIS Summary Report

Report Date: 02 Sep-17 15:07 (p 1 of 2)
Test Code: 80614 (E) | 01-2538-1748

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 00-8077-4874 | **Test Type:** | Survival-Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 28 Jul-17 14:40 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 07 Aug-17 16:30 | **Species:** | Hyalella azteca | **Brine:** | |
| **Duration:** | 10d 2h | **Source:** | Aquatic Biosystems, CO | **Age:** | 12d |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 20-1061-9557 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.4365 | 50415 passed mean dry weight-mg |
| 14-6135-8306 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.3367 | 50416 passed mean dry weight-mg |
| 10-9208-1809 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0738 | 50417 passed mean dry weight-mg |
| 00-9663-2823 | Mean Dry Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.2442 | 50418 passed mean dry weight-mg |
| 04-0408-0749 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2408 | 50419 passed mean dry weight-mg |
| 05-5693-8272 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.6586 | 50420 passed mean dry weight-mg |
| 09-4368-4703 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1389 | 50421 passed mean dry weight-mg |
| 06-1655-4543 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.6370 | 50422 passed mean dry weight-mg |
| 04-7121-4596 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1506 | 50423 passed mean dry weight-mg |
| 08-7064-7146 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2745 | 50424 passed mean dry weight-mg |
| 17-0659-6916 | Mean Dry Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.6286 | 50425 passed mean dry weight-mg |
| 20-2550-1575 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.7291 | 50426 passed mean dry weight-mg |
| 14-2969-7772 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1400 | 50427 passed mean dry weight-mg |
| 04-3839-9421 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.5600 | 50428 passed mean dry weight-mg |
| 12-1240-1166 | Mean Dry Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.3694 | 50429 passed mean dry weight-mg |
| 06-8378-0301 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50415 passed survival rate |
| 14-1976-3498 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.7154 | 50416 passed survival rate |
| 05-0429-3767 | Survival Rate | Equal Variance t Two-Sample Test | 0.0154 | 50417 failed survival rate |
| 08-0352-9269 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50418 passed survival rate |
| 21-1972-4954 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9000 | 50419 passed survival rate |
| 09-5581-1361 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50420 passed survival rate |
| 13-3188-0649 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50421 passed survival rate |
| 20-0156-1206 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50422 passed survival rate |
| 06-3310-5002 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3042 | 50423 passed survival rate |
| 02-6050-6053 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50424 passed survival rate |
| 06-3358-3542 | Survival Rate | Equal Variance t Two-Sample Test | 0.1256 | 50425 passed survival rate |
| 13-5326-9747 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3042 | 50426 passed survival rate |
| 12-9643-2034 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.9000 | 50427 passed survival rate |
| 15-2931-4813 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.3564 | 50428 passed survival rate |
| 19-8330-0271 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.5000 | 50429 passed survival rate |

### Mean Dry Weight-mg Summary

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 0.1432 | 0.1241 | 0.1623 | 0.09556 | 0.161 | 0.008064 | 0.02281 | 15.93% | 0.00% |
| 50415 | | 8 | 0.1415 | 0.1253 | 0.1577 | 0.124 | 0.184 | 0.006843 | 0.01935 | 13.68% | 1.20% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | 0.116 | 0.159 | 0.00553 | 0.01564 | 11.25% | 2.94% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.093 | 0.1533 | 0.00692 | 0.01957 | 15.42% | 11.37% |
| 50418 | | 8 | 0.1404 | 0.1245 | 0.1563 | 0.109 | 0.1556 | 0.006722 | 0.01901 | 13.54% | 1.96% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | 0.1144 | 0.154 | 0.005108 | 0.01445 | 10.60% | 4.82% |
| 50420 | | 8 | 0.1477 | 0.1306 | 0.1648 | 0.1144 | 0.1744 | 0.007228 | 0.02044 | 13.84% | -3.16% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | 0.114 | 0.1714 | 0.006377 | 0.01804 | 13.71% | 8.11% |
| 50422 | | 8 | 0.1485 | 0.1189 | 0.1781 | 0.1078 | 0.22 | 0.01251 | 0.03537 | 23.82% | -3.71% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | 0.09 | 0.1678 | 0.008523 | 0.02411 | 18.46% | 8.79% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | 0.11 | 0.163 | 0.00706 | 0.01997 | 14.62% | 4.60% |
| 50425 | | 8 | 0.1501 | 0.09243 | 0.2079 | 0.02444 | 0.2778 | 0.02441 | 0.06903 | 45.98% | -4.85% |
| 50426 | | 8 | 0.1498 | 0.1339 | 0.1656 | 0.122 | 0.181 | 0.006695 | 0.01894 | 12.65% | -4.58% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | 0.111 | 0.1611 | 0.00673 | 0.01904 | 14.49% | 8.24% |
| 50428 | | 8 | 0.1449 | 0.1264 | 0.1635 | 0.1143 | 0.189 | 0.00785 | 0.0222 | 15.32% | -1.21% |
| 50429 | | 8 | 0.1427 | 0.1234 | 0.1621 | 0.095 | 0.1633 | 0.008179 | 0.02314 | 16.21% | 0.31% |

### Survival Rate Summary

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | 0.00% |
| 50415 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |
| 50416 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | 0.00% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | 7.69% |
| 50418 | | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | 1.28% |
| 50419 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -1.28% |
| 50420 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |
| 50421 | | 8 | 0.9375 | 0.8382 | 1.0000 | 0.7000 | 1.0000 | 0.0420 | 0.1188 | 12.67% | 3.85% |
| 50422 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 3.85% |
| 50423 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 2.56% |
| 50424 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |
| 50425 | | 8 | 0.9375 | 0.8753 | 0.9997 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.94% | 3.85% |
| 50426 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | 2.56% |
| 50427 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -1.28% |
| 50428 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | 3.85% |
| 50429 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | 1.28% |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| Analysis ID: | 05-0429-3767 | Endpoint: | Survival Rate | CETIS Version: | CETISv1.9.2 |
|---|---|---|---|---|---|
| Analyzed: | 02 Sep-17 15:07 | Analysis: | Parametric-Two Sample | Official Results: | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50433 | 04-7977-3241 | 13 Jun-17 08:00 | 15 Jun-17 16:35 | 45d 7h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 51d 2h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50433 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK1900N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Angular (Corrected) | C > T | 50417 failed survival rate | 5.56% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50417* | 2.4 | 1.761 | 0.086 | 14 | CDF | 0.0154 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.054718 | 0.054718 | 1 | 5.76 | 0.0309 | Significant Effect |
| Error | 0.133005 | 0.0095004 | 14 | | | |
| Total | 0.187723 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.339 | 8.885 | 0.2849 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8798 | 0.8408 | 0.0386 | Normal Distribution |

**Survival Rate Summary**

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 0.9750 | 0.9363 | 1.0000 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 4.75% | 0.00% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.9000 | 0.8000 | 1.0000 | 0.0267 | 8.40% | 7.69% |

**Angular (Corrected) Transformed Summary**

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 8 | 1.371 | 1.308 | 1.434 | 1.412 | 1.249 | 1.412 | 0.02667 | 5.50% | 0.00% |
| 50417 | | 8 | 1.254 | 1.158 | 1.351 | 1.249 | 1.107 | 1.412 | 0.04079 | 9.20% | 8.53% |

**Survival Rate Detail**

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 1.0000 | 1.0000 | 1.0000 | 0.9000 | 1.0000 | 0.9000 | 1.0000 | 1.0000 |
| 50417 | | 1.0000 | 1.0000 | 0.8000 | 0.9000 | 0.9000 | 0.9000 | 0.8000 | 0.9000 |

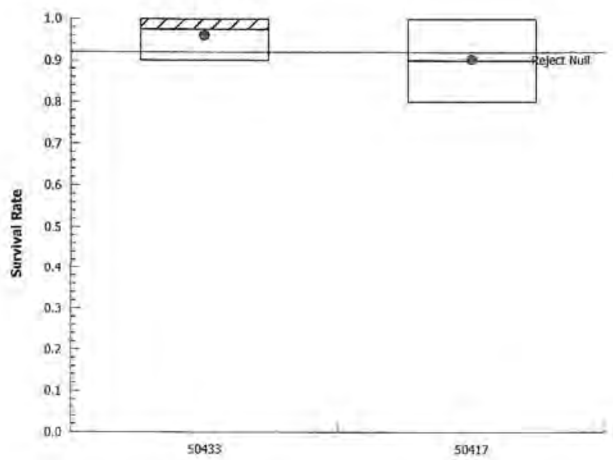
**Angular (Corrected) Transformed Detail**

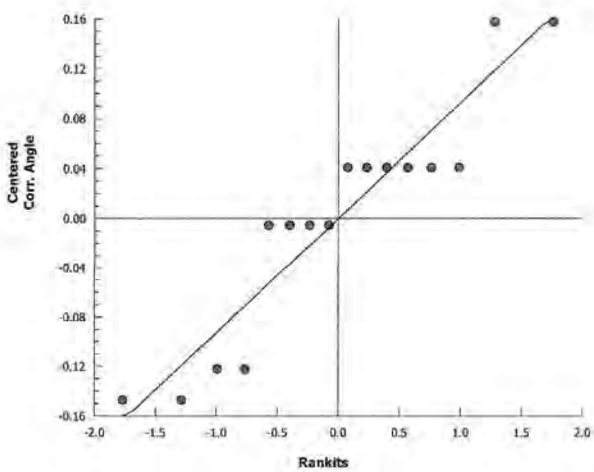
| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50433 | RS | 1.412 | 1.412 | 1.412 | 1.249 | 1.412 | 1.249 | 1.412 | 1.412 |
| 50417 | | 1.412 | 1.412 | 1.107 | 1.249 | 1.249 | 1.249 | 1.107 | 1.249 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 05-0429-3767 | **Endpoint:** | Survival Rate | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:07 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

**Graphics**



**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

**Start Date:** 28 Jul-17 14:40 **Species:** Hyalella azteca **Sample Code:** 50433
**End Date:** 07 Aug-17 16:30 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** PEPCO Benning Rd-Waterside Inve
**Sample Date:** 13 Jun-17 08:00 **Material:** Reference sediment **Sample Station:** SEDBACK1900N

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50433 | 1 | 17 | 10 | 10 | 25.29 | 23.75 | 10 | | |
| 50433 | 2 | 102 | 10 | 10 | 24.37 | 22.76 | 10 | | |
| 50433 | 3 | 60 | 10 | 10 | 24.29 | 22.68 | 10 | | |
| 50433 | 4 | 124 | 10 | 9 | 23.34 | 22.48 | 9 | | |
| 50433 | 5 | 20 | 10 | 10 | 25.1 | 23.77 | 10 | | |
| 50433 | 6 | 113 | 10 | 9 | 25.09 | 23.92 | 9 | | |
| 50433 | 7 | 54 | 10 | 10 | 25.68 | 24.08 | 10 | | |
| 50433 | 8 | 126 | 10 | 10 | 25.1 | 23.59 | 10 | | |
| 50415 | 1 | 12 | 10 | 9 | 23.34 | 22.02 | 9 | | |
| 50415 | 2 | 101 | 10 | 10 | 26.1 | 24.26 | 10 | | |
| 50415 | 3 | 26 | 10 | 10 | 25.07 | 23.65 | 10 | | |
| 50415 | 4 | 106 | 10 | 10 | 25.77 | 24.48 | 10 | | |
| 50415 | 5 | 109 | 10 | 9 | 23.64 | 22.52 | 9 | | |
| 50415 | 6 | 90 | 10 | 10 | 24.4 | 23.16 | 10 | | |
| 50415 | 7 | 49 | 10 | 9 | 26.58 | 25.35 | 9 | | |
| 50415 | 8 | 59 | 10 | 10 | 25.06 | 23.61 | 10 | | |
| 50416 | 1 | 87 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50416 | 2 | 83 | 10 | 9 | 24.87 | 23.74 | 9 | | |
| 50416 | 3 | 64 | 10 | 10 | 24.82 | 23.66 | 10 | | |
| 50416 | 4 | 14 | 10 | 10 | 24.62 | 23.03 | 10 | | |
| 50416 | 5 | 37 | 10 | 10 | 25.24 | 23.89 | 10 | | |
| 50416 | 6 | 55 | 10 | 9 | 23.17 | 21.88 | 9 | | |
| 50416 | 7 | 63 | 10 | 10 | 25.3 | 24.03 | 10 | | |
| 50416 | 8 | 76 | 10 | 10 | 25.07 | 23.5 | 10 | | |
| 50417 | 1 | 22 | 10 | 10 | 26.02 | 25.09 | 10 | | |
| 50417 | 2 | 25 | 10 | 10 | 25.21 | 23.8 | 10 | | |
| 50417 | 3 | 35 | 10 | 8 | 24.97 | 23.81 | 8 | | |
| 50417 | 4 | 92 | 10 | 9 | 24.18 | 23 | 9 | | |
| 50417 | 5 | 18 | 10 | 9 | 25.62 | 24.24 | 9 | | |
| 50417 | 6 | 29 | 10 | 9 | 24.68 | 23.6 | 9 | | |
| 50417 | 7 | 41 | 10 | 8 | 24.49 | 23.56 | 8 | | |
| 50417 | 8 | 47 | 10 | 9 | 25.33 | 24.29 | 9 | | |
| 50418 | 1 | 66 | 10 | 10 | 25.27 | 24.15 | 10 | | |
| 50418 | 2 | 105 | 10 | 8 | 23.73 | 22.51 | 8 | | |
| 50418 | 3 | 33 | 10 | 10 | 24.42 | 23.01 | 10 | | |
| 50418 | 4 | 45 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50418 | 5 | 65 | 10 | 10 | 24.4 | 22.85 | 10 | | |
| 50418 | 6 | 67 | 10 | 10 | 25.19 | 23.7 | 10 | | |
| 50418 | 7 | 100 | 10 | 10 | 26.56 | 25.47 | 10 | | |
| 50418 | 8 | 40 | 10 | 9 | 25.08 | 23.68 | 9 | | |
| 50419 | 1 | 115 | 10 | 10 | 24.88 | 23.47 | 10 | | |
| 50419 | 2 | 94 | 10 | 10 | 24.25 | 23.02 | 10 | | |
| 50419 | 3 | 75 | 10 | 10 | 24.8 | 23.56 | 10 | | |
| 50419 | 4 | 119 | 10 | 10 | 23.27 | 21.91 | 10 | | |
| 50419 | 5 | 5 | 10 | 10 | 24.23 | 23.2 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 91 | 10 | 10 | 24.88 | 23.39 | 10 | | |
| 50419 | 7 | 42 | 10 | 9 | 24.97 | 23.63 | 9 | | |
| 50419 | 8 | 48 | 10 | 10 | 24.04 | 22.5 | 10 | | |
| 50420 | 1 | 1 | 10 | 9 | 24.29 | 22.72 | 9 | | |
| 50420 | 2 | 85 | 10 | 9 | 24.81 | 23.78 | 9 | | |
| 50420 | 3 | 103 | 10 | 10 | 25.35 | 23.9 | 10 | | |
| 50420 | 4 | 98 | 10 | 10 | 23.78 | 22.45 | 10 | | |
| 50420 | 5 | 80 | 10 | 10 | 24.63 | 23.14 | 10 | | |
| 50420 | 6 | 30 | 10 | 10 | 26.24 | 24.51 | 10 | | |
| 50420 | 7 | 58 | 10 | 9 | 22.9 | 21.68 | 9 | | |
| 50420 | 8 | 2 | 11 | 11 | 27.94 | 26.21 | 11 | | |
| 50421 | 1 | 11 | 10 | 10 | 23.94 | 22.71 | 10 | | |
| 50421 | 2 | 44 | 10 | 10 | 24.16 | 22.97 | 10 | | |
| 50421 | 3 | 125 | 10 | 8 | 23.59 | 22.58 | 8 | | |
| 50421 | 4 | 84 | 10 | 7 | 26.01 | 24.81 | 7 | | |
| 50421 | 5 | 77 | 10 | 10 | 24.91 | 23.5 | 10 | | |
| 50421 | 6 | 88 | 10 | 10 | 24.23 | 22.97 | 10 | | |
| 50421 | 7 | 19 | 10 | 10 | 25.57 | 24.43 | 10 | | |
| 50421 | 8 | 116 | 10 | 10 | 25.11 | 23.79 | 10 | | |
| 50422 | 1 | 28 | 10 | 9 | 23.17 | 22.2 | 9 | | |
| 50422 | 2 | 121 | 10 | 10 | 25.72 | 24.25 | 10 | | |
| 50422 | 3 | 123 | 10 | 7 | 24.59 | 23.05 | 7 | | |
| 50422 | 4 | 110 | 10 | 10 | 24.1 | 22.82 | 10 | | |
| 50422 | 5 | 118 | 10 | 10 | 26.46 | 24.8 | 10 | | |
| 50422 | 6 | 46 | 10 | 9 | 24.75 | 23.55 | 9 | | |
| 50422 | 7 | 111 | 10 | 10 | 24.48 | 22.83 | 10 | | |
| 50422 | 8 | 96 | 10 | 10 | 24.69 | 23.48 | 10 | | |
| 50423 | 1 | 16 | 10 | 9 | 23.64 | 22.67 | 8 | | |
| 50423 | 2 | 127 | 10 | 9 | 25.33 | 24.19 | 9 | | |
| 50423 | 3 | 57 | 11 | 11 | 24.46 | 23.47 | 11 | | |
| 50423 | 4 | 122 | 10 | 9 | 25.27 | 23.76 | 9 | | |
| 50423 | 5 | 120 | 10 | 10 | 25.38 | 23.91 | 10 | | |
| 50423 | 6 | 70 | 10 | 10 | 22.79 | 21.63 | 10 | | |
| 50423 | 7 | 9 | 10 | 9 | 23.8 | 22.44 | 9 | | |
| 50423 | 8 | 104 | 10 | 10 | 24.53 | 23.28 | 10 | | |
| 50424 | 1 | 53 | 10 | 9 | 23.04 | 21.9 | 9 | | |
| 50424 | 2 | 21 | 10 | 10 | 23.67 | 22.04 | 10 | | |
| 50424 | 3 | 81 | 10 | 10 | 23.34 | 22.24 | 10 | | |
| 50424 | 4 | 79 | 10 | 10 | 24.56 | 23.12 | 10 | | |
| 50424 | 5 | 23 | 10 | 10 | 24.84 | 23.27 | 10 | | |
| 50424 | 6 | 74 | 10 | 9 | 23.87 | 22.86 | 9 | | |
| 50424 | 7 | 73 | 10 | 10 | 24.69 | 23.19 | 10 | | |
| 50424 | 8 | 36 | 10 | 9 | 24.05 | 22.88 | 9 | | |
| 50425 | 1 | 68 | 10 | 8 | 24.5 | 23.17 | 8 | | |
| 50425 | 2 | 56 | 10 | 10 | 23.31 | 21.76 | 10 | | |
| 50425 | 3 | 99 | 10 | 10 | 24.12 | 22.73 | 10 | | |
| 50425 | 4 | 3 | 10 | 10 | 23.22 | 21.63 | 10 | | |
| 50425 | 5 | 39 | 10 | 10 | 25.86 | 24.63 | 10 | | |
| 50425 | 6 | 34 | 10 | 9 | 23.13 | 22.91 | 9 | | |
| 50425 | 7 | 7 | 10 | 9 | 25.38 | 23.97 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 82 | 10 | 9 | 26.9 | 24.4 | 9 | | |
| 50426 | 1 | 15 | 10 | 9 | 25.12 | 23.93 | 9 | | |
| 50426 | 2 | 117 | 10 | 9 | 24.84 | 23.47 | 9 | | |
| 50426 | 3 | 27 | 10 | 10 | 25.04 | 23.82 | 10 | | |
| 50426 | 4 | 52 | 10 | 9 | 25.87 | 24.56 | 9 | | |
| 50426 | 5 | 51 | 10 | 9 | 23.83 | 22.39 | 9 | | |
| 50426 | 6 | 89 | 10 | 10 | 24.8 | 23.15 | 10 | | |
| 50426 | 7 | 32 | 10 | 10 | 24.74 | 22.93 | 10 | | |
| 50426 | 8 | 108 | 10 | 10 | 23.83 | 22.43 | 10 | | |
| 50427 | 1 | 62 | 10 | 10 | 24.83 | 23.55 | 10 | | |
| 50427 | 2 | 107 | 10 | 10 | 25.06 | 23.87 | 10 | | |
| 50427 | 3 | 93 | 10 | 10 | 23.27 | 21.7 | 10 | | |
| 50427 | 4 | 95 | 10 | 10 | 24.39 | 23.28 | 10 | | |
| 50427 | 5 | 86 | 10 | 10 | 24.48 | 23.3 | 10 | | |
| 50427 | 6 | 78 | 10 | 10 | 24.11 | 22.72 | 10 | | |
| 50427 | 7 | 128 | 10 | 9 | 25.14 | 23.69 | 9 | | |
| 50427 | 8 | 69 | 10 | 10 | 24.12 | 22.94 | 10 | | |
| 50428 | 1 | 112 | 10 | 10 | 24.98 | 23.79 | 9 | | |
| 50428 | 2 | 10 | 10 | 10 | 26.1 | 24.21 | 10 | | |
| 50428 | 3 | 13 | 10 | 10 | 24.77 | 23.52 | 9 | | |
| 50428 | 4 | 114 | 10 | 9 | 23.63 | 22.42 | 9 | | |
| 50428 | 5 | 38 | 10 | 9 | 24.89 | 23.59 | 9 | | |
| 50428 | 6 | 24 | 10 | 10 | 25.09 | 23.64 | 9 | | |
| 50428 | 7 | 31 | 10 | 10 | 23.04 | 21.59 | 10 | | |
| 50428 | 8 | 4 | 10 | 7 | 25.46 | 24.66 | 7 | | |
| 50429 | 1 | 97 | 10 | 10 | 23.63 | 22.31 | 10 | | |
| 50429 | 2 | 6 | 10 | 10 | 29.23 | 27.73 | 10 | | |
| 50429 | 3 | 71 | 10 | 10 | 25.02 | 23.43 | 10 | | |
| 50429 | 4 | 50 | 10 | 9 | 24.91 | 23.68 | 8 | | |
| 50429 | 5 | 43 | 10 | 9 | 25.29 | 23.82 | 9 | | |
| 50429 | 6 | 8 | 10 | 9 | 25.27 | 24.11 | 9 | | |
| 50429 | 7 | 61 | 10 | 10 | 22.75 | 21.8 | 10 | | |
| 50429 | 8 | 72 | 10 | 10 | 24.32 | 22.72 | 10 | | |

*Hyalella azteca*

10-day survival and

growth test (dry weight)

Statistical analysis of test data compared to

REFERENCE SEDBACK2000N

(Aquatec Sample # 50434)

STATISTICAL COMPARISONS TO 50434 (SEDBACKZ000N)

# CETIS Summary Report

Report Date: 02 Sep-17 15:13 (p 1 of 2)
Test Code: 80615 (F) | 12-1949-8999

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Batch ID:** | 00-8077-4874 | **Test Type:** | Survival-Growth | **Analyst:** | Kaitlyn Priest |
| **Start Date:** | 28 Jul-17 14:40 | **Protocol:** | EPA/600/R-99/064 (2000) | **Diluent:** | Reconstituted Water |
| **Ending Date:** | 07 Aug-17 16:30 | **Species:** | Hyalella azteca | **Brine:** | |
| **Duration:** | 10d 2h | **Source:** | Aquatic Biosystems, CO | **Age:** | 12d |

**Single Comparison Summary**

| Analysis ID | Endpoint | Comparison Method | P-Value | Comparison Result |
|---|---|---|---|---|
| 03-0655-5643 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0815 | 50415 passed mean dry weight-mg |
| 14-2441-8194 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0308 | 50416 failed mean dry weight-mg |
| 17-8777-2103 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0031 | 50417 failed mean dry weight-mg |
| 18-8555-9963 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0633 | 50418 passed mean dry weight-mg |
| 11-2596-1000 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0123 | 50419 failed mean dry weight-mg |
| 06-0929-6846 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.2510 | 50420 passed mean dry weight-mg |
| 11-4515-0701 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0071 | 50421 failed mean dry weight-mg |
| 11-7849-9075 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.3536 | 50422 passed mean dry weight-mg |
| 07-2335-0642 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0162 | 50423 failed mean dry weight-mg |
| 18-0399-9285 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0317 | 50424 failed mean dry weight-mg |
| 16-4761-1860 | Mean Dry Weight-mg | Wilcoxon Rank Sum Two-Sample Test | 0.4796 | 50425 passed mean dry weight-mg |
| 20-2328-3888 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.3205 | 50426 passed mean dry weight-mg |
| 21-1671-6821 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.0082 | 50427 failed mean dry weight-mg |
| 05-8026-5853 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1778 | 50428 passed mean dry weight-mg |
| 09-2783-2574 | Mean Dry Weight-mg | Equal Variance t Two-Sample Test | 0.1331 | 50429 passed mean dry weight-mg |
| 07-1978-2231 | Survival Rate | Equal Variance t Two-Sample Test | 0.9455 | 50415 passed survival rate |
| 06-5202-9217 | Survival Rate | Equal Variance t Two-Sample Test | 0.9795 | 50416 passed survival rate |
| 00-6434-8270 | Survival Rate | Equal Variance t Two-Sample Test | 0.3733 | 50417 passed survival rate |
| 01-1376-6303 | Survival Rate | Equal Variance t Two-Sample Test | 0.9245 | 50418 passed survival rate |
| 18-3656-4820 | Survival Rate | Equal Variance t Two-Sample Test | 0.9947 | 50419 passed survival rate |
| 12-6292-1674 | Survival Rate | Equal Variance t Two-Sample Test | 0.9467 | 50420 passed survival rate |
| 11-1482-3266 | Survival Rate | Wilcoxon Rank Sum Two-Sample Test | 0.8949 | 50421 passed survival rate |
| 15-2194-9233 | Survival Rate | Equal Variance t Two-Sample Test | 0.7607 | 50422 passed survival rate |
| 05-6737-1765 | Survival Rate | Equal Variance t Two-Sample Test | 0.8868 | 50423 passed survival rate |
| 16-9445-6553 | Survival Rate | Equal Variance t Two-Sample Test | 0.9455 | 50424 passed survival rate |
| 15-0693-3382 | Survival Rate | Equal Variance t Two-Sample Test | 0.7688 | 50425 passed survival rate |
| 12-1062-5633 | Survival Rate | Equal Variance t Two-Sample Test | 0.8845 | 50426 passed survival rate |
| 00-8864-1786 | Survival Rate | Equal Variance t Two-Sample Test | 0.9947 | 50427 passed survival rate |
| 04-0928-7066 | Survival Rate | Equal Variance t Two-Sample Test | 0.7607 | 50428 passed survival rate |
| 08-7471-5553 | Survival Rate | Equal Variance t Two-Sample Test | 0.9455 | 50429 passed survival rate |

Hyalella 10-d Survival and Growth Sediment Test — Aquatec Environmental, Inc.

### Mean Dry Weight-mg Summary

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1389 | 0.1775 | 0.004617 | 0.01306 | 8.50% | 0.00% |
| 50415 | | 8 | 0.1415 | 0.1253 | 0.1577 | 0.124 | 0.184 | 0.006843 | 0.01935 | 13.68% | 7.91% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | 0.116 | 0.159 | 0.00553 | 0.01564 | 11.25% | 9.53% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.093 | 0.1533 | 0.00692 | 0.01957 | 15.42% | 17.39% |
| 50418 | | 8 | 0.1404 | 0.1245 | 0.1563 | 0.109 | 0.1556 | 0.006722 | 0.01901 | 13.54% | 8.62% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | 0.1144 | 0.154 | 0.005108 | 0.01445 | 10.60% | 11.28% |
| 50420 | | 8 | 0.1477 | 0.1306 | 0.1648 | 0.1144 | 0.1744 | 0.007228 | 0.02044 | 13.84% | 3.85% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | 0.114 | 0.1714 | 0.006377 | 0.01804 | 13.71% | 14.35% |
| 50422 | | 8 | 0.1485 | 0.1189 | 0.1781 | 0.1078 | 0.22 | 0.01251 | 0.03537 | 23.82% | 3.33% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | 0.09 | 0.1678 | 0.008523 | 0.02411 | 18.46% | 14.99% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | 0.11 | 0.163 | 0.00706 | 0.01997 | 14.62% | 11.07% |
| 50425 | | 8 | 0.1501 | 0.09243 | 0.2079 | 0.02444 | 0.2778 | 0.02441 | 0.06903 | 45.98% | 2.27% |
| 50426 | | 8 | 0.1498 | 0.1339 | 0.1656 | 0.122 | 0.181 | 0.006695 | 0.01894 | 12.65% | 2.52% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | 0.111 | 0.1611 | 0.00673 | 0.01904 | 14.49% | 14.47% |
| 50428 | | 8 | 0.1449 | 0.1264 | 0.1635 | 0.1143 | 0.189 | 0.00785 | 0.0222 | 15.32% | 5.66% |
| 50429 | | 8 | 0.1427 | 0.1234 | 0.1621 | 0.095 | 0.1633 | 0.008179 | 0.02314 | 16.21% | 7.08% |

### Survival Rate Summary

| Group | Code | Count | Mean | 95% LCL | 95% UCL | Min | Max | Std Err | Std Dev | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.9125 | 0.8589 | 0.9661 | 0.8000 | 1.0000 | 0.0227 | 0.0641 | 7.02% | 0.00% |
| 50415 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -5.48% |
| 50416 | | 8 | 0.9750 | 0.9363 | 1.0000 | 0.9000 | 1.0000 | 0.0164 | 0.0463 | 4.75% | -6.85% |
| 50417 | | 8 | 0.9000 | 0.8368 | 0.9632 | 0.8000 | 1.0000 | 0.0267 | 0.0756 | 8.40% | 1.37% |
| 50418 | | 8 | 0.9625 | 0.9003 | 1.0000 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.73% | -5.48% |
| 50419 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -8.22% |
| 50420 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -5.48% |
| 50421 | | 8 | 0.9375 | 0.8382 | 1.0000 | 0.7000 | 1.0000 | 0.0420 | 0.1188 | 12.67% | -2.74% |
| 50422 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | -2.74% |
| 50423 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | -4.11% |
| 50424 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -5.48% |
| 50425 | | 8 | 0.9375 | 0.8753 | 0.9997 | 0.8000 | 1.0000 | 0.0263 | 0.0744 | 7.94% | -2.74% |
| 50426 | | 8 | 0.9500 | 0.9053 | 0.9947 | 0.9000 | 1.0000 | 0.0189 | 0.0535 | 5.63% | -4.11% |
| 50427 | | 8 | 0.9875 | 0.9579 | 1.0000 | 0.9000 | 1.0000 | 0.0125 | 0.0354 | 3.58% | -8.22% |
| 50428 | | 8 | 0.9375 | 0.8488 | 1.0000 | 0.7000 | 1.0000 | 0.0375 | 0.1061 | 11.31% | -2.74% |
| 50429 | | 8 | 0.9625 | 0.9192 | 1.0000 | 0.9000 | 1.0000 | 0.0183 | 0.0518 | 5.38% | -5.48% |

# CETIS Analytical Report

| | | | |
|---|---|---|---|
| | | Report Date: | 02 Sep-17 15:16 (p 1 of 1) |
| | | Test Code: | 80615 (F) \| 12-1949-8999 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 14-2441-8194 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 45d 5h | AECOM (MA) | Sediment Testing |
| 50416 | 17-8931-1896 | 07 Jun-17 11:30 | 15 Jun-17 16:35 | 51d 3h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50416 | Sediment | PEPCO Benning Rd-Waterside In | SED8C00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50416 failed mean dry weight-mg | 8.26% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50416* | 2.032 | 1.761 | 0.013 | 14 | CDF | 0.0308 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0008572 | 0.0008572 | 1 | 4.129 | 0.0616 | Non-Significant Effect |
| Error | 0.0029061 | 0.0002076 | 14 | | | |
| Total | 0.0037633 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.435 | 8.885 | 0.6457 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9571 | 0.8408 | 0.6105 | Normal Distribution |

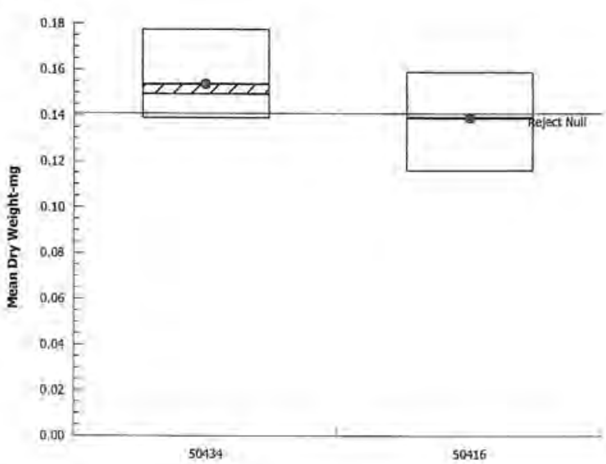
**Mean Dry Weight-mg Summary**

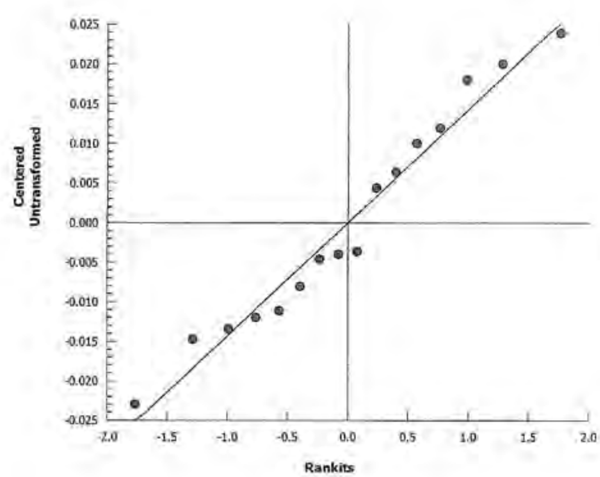
| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1495 | 0.1389 | 0.1775 | 0.004617 | 8.50% | 0.00% |
| 50416 | | 8 | 0.139 | 0.1259 | 0.1521 | 0.1392 | 0.116 | 0.159 | 0.00553 | 11.25% | 9.53% |

**Mean Dry Weight-mg Detail**

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 0.1425 | 0.16 | 0.1456 | 0.1656 | 0.1775 | 0.1389 | 0.149 | 0.15 |
| 50416 | | 0.149 | 0.1256 | 0.116 | 0.159 | 0.135 | 0.1433 | 0.127 | 0.157 |

**Graphics**



# CETIS Analytical Report

Report Date: 02 Sep-17 15:16 (p 1 of 1)
Test Code: 80615 (F) | 12-1949-8999

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 17-8777-2103 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 45d 5h | AECOM (MA) | Sediment Testing |
| 50417 | 02-7975-1915 | 07 Jun-17 12:30 | 15 Jun-17 16:35 | 51d 2h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50417 | Sediment | PEPCO Benning Rd-Waterside In | SED7B00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50417 failed mean dry weight-mg | 9.54% |

**Equal Variance t Two-Sample Test**

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Reference Sed | | 50417* | 3.212 | 1.761 | 0.015 | 14 | CDF | 0.0031 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0028556 | 0.0028556 | 1 | 10.32 | 0.0063 | Significant Effect |
| Error | 0.0038754 | 0.0002768 | 14 | | | |
| Total | 0.006731 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.247 | 8.885 | 0.3075 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9577 | 0.8408 | 0.6209 | Normal Distribution |

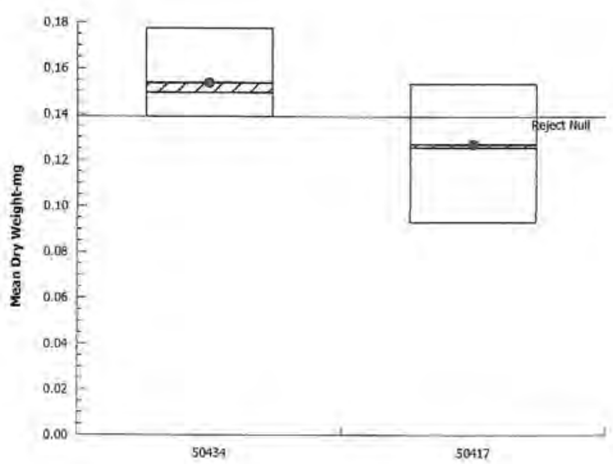
**Mean Dry Weight-mg Summary**

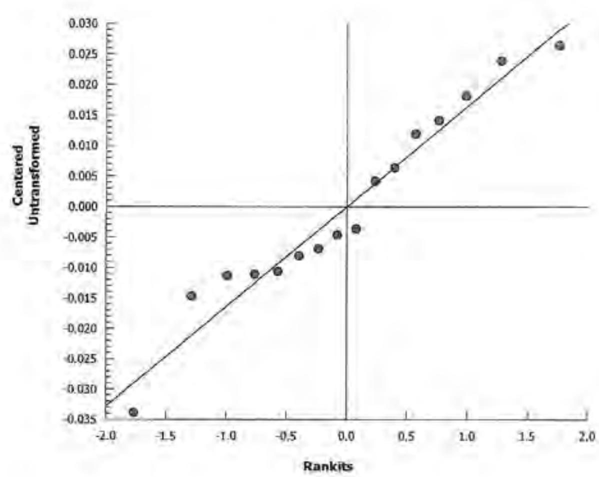
| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1495 | 0.1389 | 0.1775 | 0.004617 | 8.50% | 0.00% |
| 50417 | | 8 | 0.1269 | 0.1105 | 0.1433 | 0.1256 | 0.093 | 0.1533 | 0.00692 | 15.42% | 17.39% |

**Mean Dry Weight-mg Detail**

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 0.1425 | 0.16 | 0.1456 | 0.1656 | 0.1775 | 0.1389 | 0.149 | 0.15 |
| 50417 | | 0.093 | 0.141 | 0.145 | 0.1311 | 0.1533 | 0.12 | 0.1163 | 0.1156 |

**Graphics**



## CETIS Analytical Report

Report Date: 02 Sep-17 15:15 (p 1 of 1)
Test Code: 80615 (F) | 12-1949-8999

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 11-2596-1000 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 45d 5h | AECOM (MA) | Sediment Testing |
| 50419 | 01-1666-6562 | 08 Jun-17 09:15 | 15 Jun-17 16:35 | 50d 5h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50419 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50419 failed mean dry weight-mg | 7.89% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50419* | 2.518 | 1.761 | 0.012 | 14 | CDF | 0.0123 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0012018 | 0.0012018 | 1 | 6.338 | 0.0246 | Significant Effect |
| Error | 0.0026547 | 0.0001896 | 14 | | | |
| Total | 0.0038564 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.224 | 8.885 | 0.7964 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9638 | 0.8408 | 0.7309 | Normal Distribution |

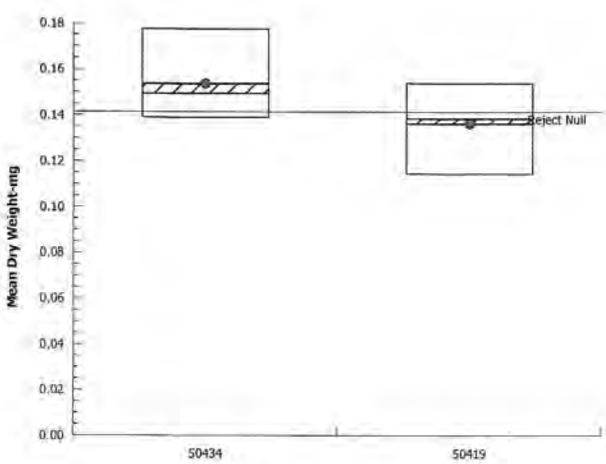
### Mean Dry Weight-mg Summary

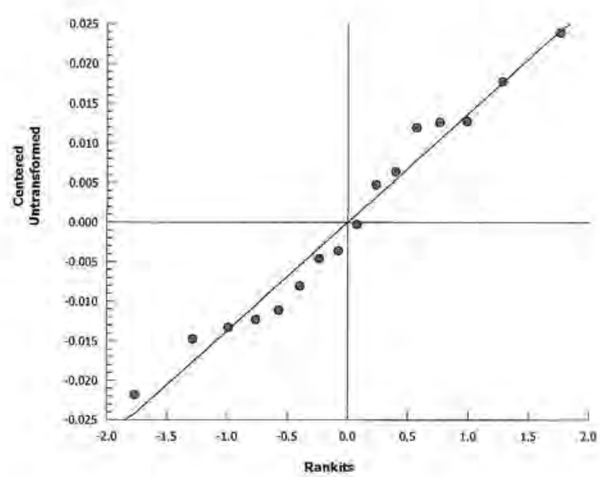
| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1495 | 0.1389 | 0.1775 | 0.004617 | 8.50% | 0.00% |
| 50419 | | 8 | 0.1363 | 0.1242 | 0.1484 | 0.1385 | 0.1144 | 0.154 | 0.005108 | 10.60% | 11.28% |

### Mean Dry Weight-mg Detail

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 0.1425 | 0.16 | 0.1456 | 0.1656 | 0.1775 | 0.1389 | 0.149 | 0.15 |
| 50419 | | 0.141 | 0.123 | 0.124 | 0.136 | 0.1144 | 0.149 | 0.1489 | 0.154 |

### Graphics



**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 11-4515-0701 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 45d 5h | AECOM (MA) | Sediment Testing |
| 50421 | 10-8432-1021 | 08 Jun-17 10:30 | 15 Jun-17 16:35 | 50d 4h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50421 | Sediment | PEPCO Benning Rd-Waterside In | SED7E00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50421 failed mean dry weight-mg | 9.03% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50421* | 2.8 | 1.761 | 0.014 | 14 | CDF | 0.0071 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0019431 | 0.0019431 | 1 | 7.838 | 0.0142 | Significant Effect |
| Error | 0.0034709 | 0.0002479 | 14 | | | |
| Total | 0.005414 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 1.908 | 8.885 | 0.4134 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8732 | 0.8408 | 0.0305 | Normal Distribution |

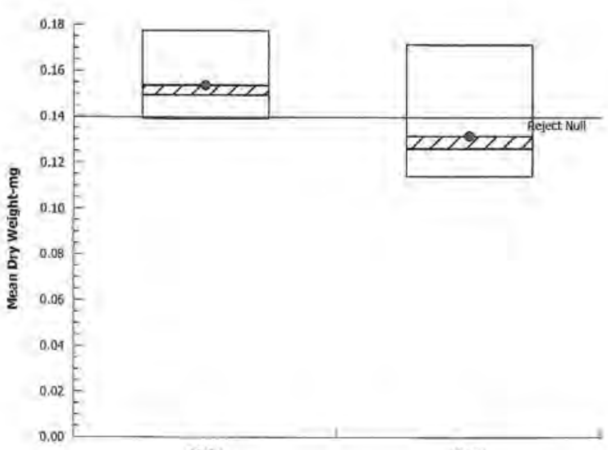
### Mean Dry Weight-mg Summary

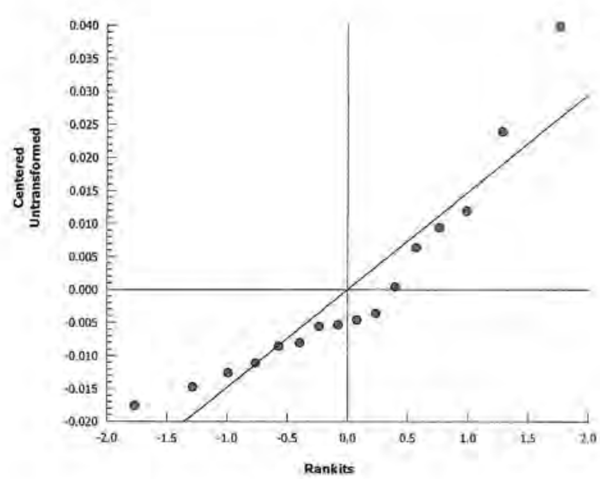
| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1495 | 0.1389 | 0.1775 | 0.004617 | 8.50% | 0.00% |
| 50421 | | 8 | 0.1316 | 0.1165 | 0.1467 | 0.1261 | 0.114 | 0.1714 | 0.006377 | 13.71% | 14.35% |

### Mean Dry Weight-mg Detail

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 0.1425 | 0.16 | 0.1456 | 0.1656 | 0.1775 | 0.1389 | 0.149 | 0.15 |
| 50421 | | 0.123 | 0.119 | 0.1263 | 0.1714 | 0.141 | 0.126 | 0.114 | 0.132 |

### Graphics



## CETIS Analytical Report

| Report Date: | 02 Sep-17 15:15 (p 1 of 1) |
|---|---|
| Test Code: | 80615 (F) \| 12-1949-8999 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 07-2335-0642 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 45d 5h | AECOM (MA) | Sediment Testing |
| 50423 | 06-3488-3136 | 08 Jun-17 13:15 | 15 Jun-17 16:35 | 50d 1h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50423 | Sediment | PEPCO Benning Rd-Waterside In | SED6A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50423 failed mean dry weight-mg | 11.11% |

**Equal Variance t Two-Sample Test**

| Sample I | vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|---|
| Reference Sed | | 50423* | 2.375 | 1.761 | 0.017 | 14 | CDF | 0.0162 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0021205 | 0.0021205 | 1 | 5.643 | 0.0324 | Significant Effect |
| Error | 0.0052612 | 0.0003758 | 14 | | | |
| Total | 0.0073817 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 3.408 | 8.885 | 0.1281 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9548 | 0.8408 | 0.5695 | Normal Distribution |

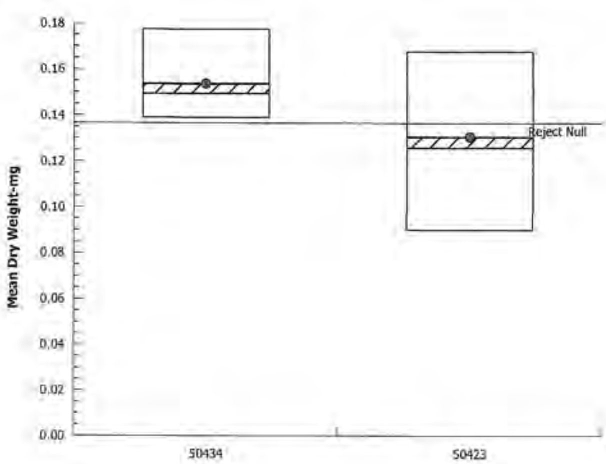
**Mean Dry Weight-mg Summary**

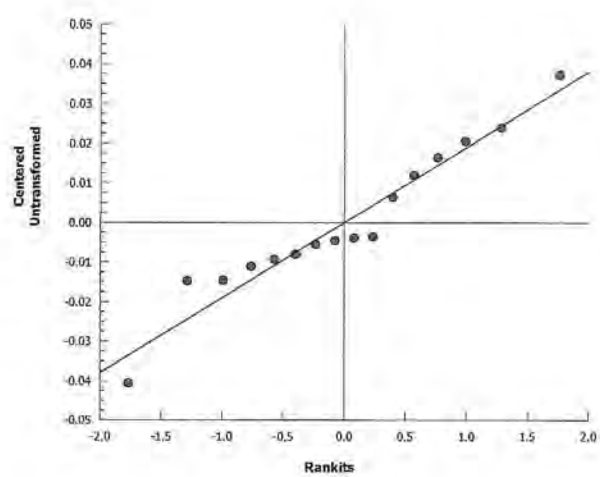
| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1495 | 0.1389 | 0.1775 | 0.004617 | 8.50% | 0.00% |
| 50423 | | 8 | 0.1306 | 0.1104 | 0.1508 | 0.1258 | 0.09 | 0.1678 | 0.008523 | 18.46% | 14.99% |

**Mean Dry Weight-mg Detail**

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 0.1425 | 0.16 | 0.1456 | 0.1656 | 0.1775 | 0.1389 | 0.149 | 0.15 |
| 50423 | | 0.1212 | 0.1267 | 0.09 | 0.1678 | 0.147 | 0.116 | 0.1511 | 0.125 |

**Graphics**



## CETIS Analytical Report

| | |
|---|---|
| Report Date: | 02 Sep-17 15:15 (p 1 of 1) |
| Test Code: | 80615 (F) \| 12-1949-8999 |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 18-0399-9285 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 45d 5h | AECOM (MA) | Sediment Testing |
| 50424 | 00-7068-4401 | 09 Jun-17 08:15 | 15 Jun-17 16:35 | 49d 6h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50424 | Sediment | PEPCO Benning Rd-Waterside In | SED7.5D00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50424 failed mean dry weight-mg | 9.67% |

### Equal Variance t Two-Sample Test

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50424* | 2.017 | 1.761 | 0.015 | 14 | CDF | 0.0317 | Significant Effect |

### ANOVA Table

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0011579 | 0.0011579 | 1 | 4.068 | 0.0633 | Non-Significant Effect |
| Error | 0.0039851 | 0.0002846 | 14 | | | |
| Total | 0.005143 | | 15 | | | |

### Distributional Tests

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.339 | 8.885 | 0.2848 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.9583 | 0.8408 | 0.6312 | Normal Distribution |

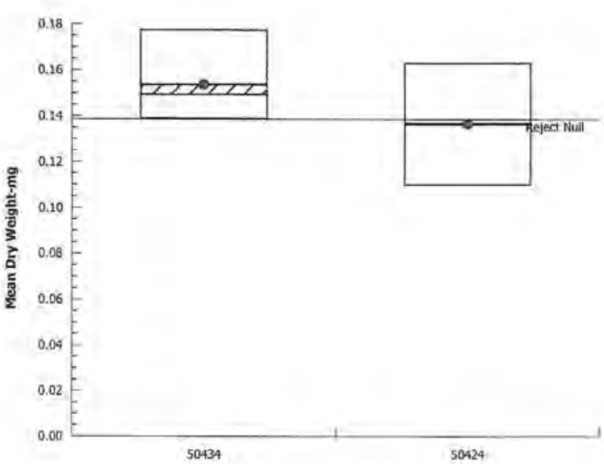
### Mean Dry Weight-mg Summary

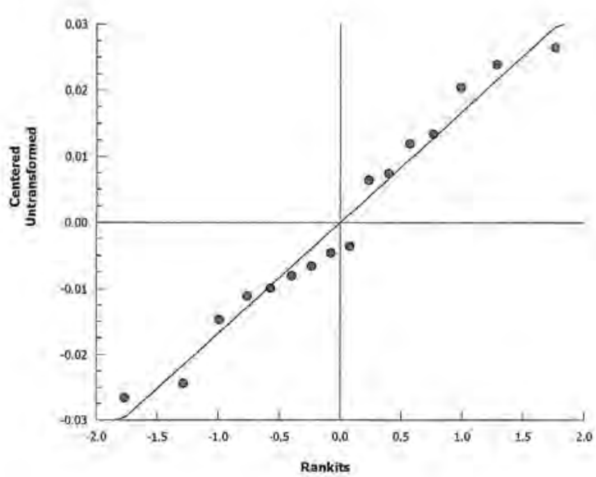
| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1495 | 0.1389 | 0.1775 | 0.004617 | 8.50% | 0.00% |
| 50424 | | 8 | 0.1366 | 0.1199 | 0.1533 | 0.137 | 0.11 | 0.163 | 0.00706 | 14.62% | 11.07% |

### Mean Dry Weight-mg Detail

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 0.1425 | 0.16 | 0.1456 | 0.1656 | 0.1775 | 0.1389 | 0.149 | 0.15 |
| 50424 | | 0.1267 | 0.163 | 0.11 | 0.144 | 0.157 | 0.1122 | 0.15 | 0.13 |

### Graphics



# CETIS Analytical Report

| | | | |
|---|---|---|---|
| Report Date: | 02 Sep-17 15:14 (p 1 of 1) | | |
| Test Code: | 80615 (F) \| 12-1949-8999 | | |

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Analysis ID:** | 21-1671-6821 | **Endpoint:** | Mean Dry Weight-mg | **CETIS Version:** | CETISv1.9.2 |
| **Analyzed:** | 02 Sep-17 15:13 | **Analysis:** | Parametric-Two Sample | **Official Results:** | Yes |

| Sample Code | Sample ID | Sample Date | Receipt Date | Sample Age | Client Name | Project |
|---|---|---|---|---|---|---|
| 50434 | 20-5798-9009 | 13 Jun-17 09:45 | 15 Jun-17 16:35 | 45d 5h | AECOM (MA) | Sediment Testing |
| 50427 | 18-6592-9282 | 09 Jun-17 10:30 | 15 Jun-17 16:35 | 49d 4h | | |

| Sample Code | Material Type | Sample Source | Station Location | Lat/Long |
|---|---|---|---|---|
| 50434 | Reference sediment | PEPCO Benning Rd-Waterside In | SEDBACK2000N | |
| 50427 | Sediment | PEPCO Benning Rd-Waterside In | SED8A00EN | |

| Data Transform | Alt Hyp | Comparison Result | PMSD |
|---|---|---|---|
| Untransformed | C > T | 50427 failed mean dry weight-mg | 9.36% |

**Equal Variance t Two-Sample Test**

| Sample I vs | Sample II | Test Stat | Critical | MSD | DF | P-Type | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|---|---|
| Reference Sed | 50427* | 2.725 | 1.761 | 0.014 | 14 | CDF | 0.0082 | Significant Effect |

**ANOVA Table**

| Source | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision(α:5%) |
|---|---|---|---|---|---|---|
| Between | 0.0019778 | 0.0019778 | 1 | 7.423 | 0.0164 | Significant Effect |
| Error | 0.0037300 | 0.0002664 | 14 | | | |
| Total | 0.0057078 | | 15 | | | |

**Distributional Tests**

| Attribute | Test | Test Stat | Critical | P-Value | Decision(α:1%) |
|---|---|---|---|---|---|
| Variances | Variance Ratio F Test | 2.125 | 8.885 | 0.3412 | Equal Variances |
| Distribution | Shapiro-Wilk W Normality Test | 0.8976 | 0.8408 | 0.0736 | Normal Distribution |

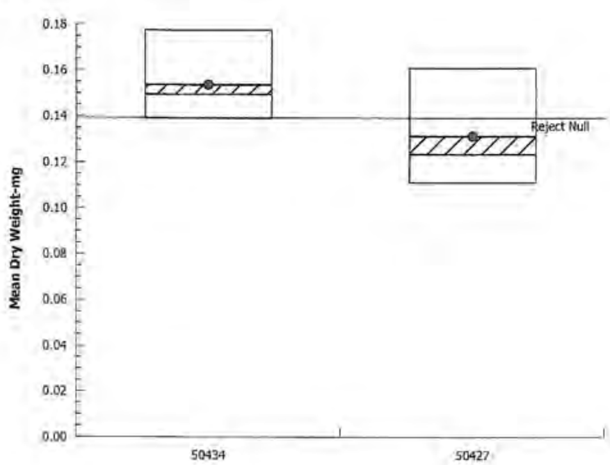
**Mean Dry Weight-mg Summary**

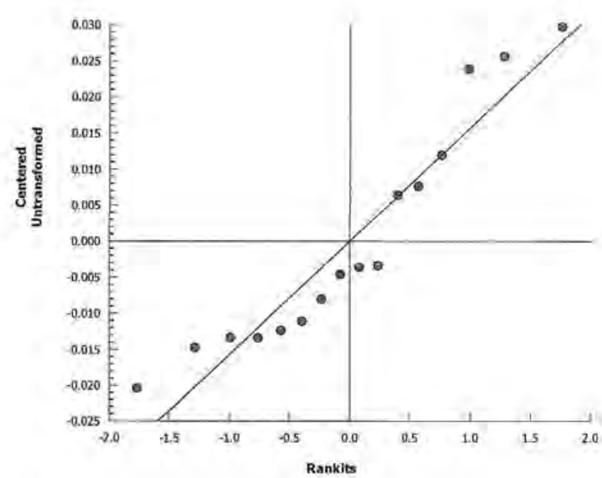
| Group | Code | Count | Mean | 95% LCL | 95% UCL | Median | Min | Max | Std Err | CV% | %Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 8 | 0.1536 | 0.1427 | 0.1645 | 0.1495 | 0.1389 | 0.1775 | 0.004617 | 8.50% | 0.00% |
| 50427 | | 8 | 0.1314 | 0.1155 | 0.1473 | 0.1235 | 0.111 | 0.1611 | 0.00673 | 14.49% | 14.47% |

**Mean Dry Weight-mg Detail**

| Group | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 | Rep 5 | Rep 6 | Rep 7 | Rep 8 |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | RS | 0.1425 | 0.16 | 0.1456 | 0.1656 | 0.1775 | 0.1389 | 0.149 | 0.15 |
| 50427 | | 0.128 | 0.119 | 0.157 | 0.111 | 0.118 | 0.139 | 0.1611 | 0.118 |

**Graphics**



## CETIS Test Data Worksheet

Report Date: 02 Sep-17 15:12 (p 1 of 3)
Test Code/ID: 12-1949-8999/80615 (F)

**Hyalella 10-d Survival and Growth Sediment Test** — **Aquatec Environmental, Inc.**

| | | | | | |
|---|---|---|---|---|---|
| **Start Date:** | 28 Jul-17 14:40 | **Species:** | Hyalella azteca | **Sample Code:** | 50434 |
| **End Date:** | 07 Aug-17 16:30 | **Protocol:** | EPA/600/R-99/064 (2000) | **Sample Source:** | PEPCO Benning Rd-Waterside Inve |
| **Sample Date:** | 13 Jun-17 09:45 | **Material:** | Reference sediment | **Sample Station:** | SEDBACK2000N |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50434 | 1 | 106 | 10 | 9 | 23.85 | 22.71 | 8 | | |
| 50434 | 2 | 52 | 10 | 9 | 24.17 | 22.73 | 9 | | |
| 50434 | 3 | 75 | 10 | 9 | 24.23 | 22.92 | 9 | | |
| 50434 | 4 | 47 | 10 | 9 | 23.29 | 21.8 | 9 | | |
| 50434 | 5 | 13 | 10 | 8 | 25.28 | 23.86 | 8 | | |
| 50434 | 6 | 90 | 10 | 9 | 24.9 | 23.65 | 9 | | |
| 50434 | 7 | 95 | 10 | 10 | 24.96 | 23.47 | 10 | | |
| 50434 | 8 | 59 | 10 | 10 | 24.4 | 22.9 | 10 | | |
| 50415 | 1 | 53 | 10 | 9 | 23.34 | 22.02 | 9 | | |
| 50415 | 2 | 107 | 10 | 10 | 26.1 | 24.26 | 10 | | |
| 50415 | 3 | 38 | 10 | 10 | 25.07 | 23.65 | 10 | | |
| 50415 | 4 | 43 | 10 | 10 | 25.77 | 24.48 | 10 | | |
| 50415 | 5 | 26 | 10 | 9 | 23.64 | 22.52 | 9 | | |
| 50415 | 6 | 120 | 10 | 10 | 24.4 | 23.16 | 10 | | |
| 50415 | 7 | 112 | 10 | 9 | 26.58 | 25.35 | 9 | | |
| 50415 | 8 | 46 | 10 | 10 | 25.06 | 23.61 | 10 | | |
| 50416 | 1 | 123 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50416 | 2 | 31 | 10 | 9 | 24.87 | 23.74 | 9 | | |
| 50416 | 3 | 1 | 10 | 10 | 24.82 | 23.66 | 10 | | |
| 50416 | 4 | 122 | 10 | 10 | 24.62 | 23.03 | 10 | | |
| 50416 | 5 | 87 | 10 | 10 | 25.24 | 23.89 | 10 | | |
| 50416 | 6 | 85 | 10 | 9 | 23.17 | 21.88 | 9 | | |
| 50416 | 7 | 73 | 10 | 10 | 25.3 | 24.03 | 10 | | |
| 50416 | 8 | 11 | 10 | 10 | 25.07 | 23.5 | 10 | | |
| 50417 | 1 | 69 | 10 | 10 | 26.02 | 25.09 | 10 | | |
| 50417 | 2 | 109 | 10 | 10 | 25.21 | 23.8 | 10 | | |
| 50417 | 3 | 8 | 10 | 8 | 24.97 | 23.81 | 8 | | |
| 50417 | 4 | 96 | 10 | 9 | 24.18 | 23 | 9 | | |
| 50417 | 5 | 58 | 10 | 9 | 25.62 | 24.24 | 9 | | |
| 50417 | 6 | 102 | 10 | 9 | 24.68 | 23.6 | 9 | | |
| 50417 | 7 | 25 | 10 | 8 | 24.49 | 23.56 | 8 | | |
| 50417 | 8 | 35 | 10 | 9 | 25.33 | 24.29 | 9 | | |
| 50418 | 1 | 105 | 10 | 10 | 25.27 | 24.15 | 10 | | |
| 50418 | 2 | 36 | 10 | 8 | 23.73 | 22.51 | 8 | | |
| 50418 | 3 | 80 | 10 | 10 | 24.42 | 23.01 | 10 | | |
| 50418 | 4 | 30 | 10 | 10 | 24.4 | 22.91 | 10 | | |
| 50418 | 5 | 3 | 10 | 10 | 24.4 | 22.85 | 10 | | |
| 50418 | 6 | 97 | 10 | 10 | 25.19 | 23.7 | 10 | | |
| 50418 | 7 | 128 | 10 | 10 | 26.56 | 25.47 | 10 | | |
| 50418 | 8 | 88 | 10 | 9 | 25.08 | 23.68 | 9 | | |
| 50419 | 1 | 68 | 10 | 10 | 24.88 | 23.47 | 10 | | |
| 50419 | 2 | 114 | 10 | 10 | 24.25 | 23.02 | 10 | | |
| 50419 | 3 | 111 | 10 | 10 | 24.8 | 23.56 | 10 | | |
| 50419 | 4 | 55 | 10 | 10 | 23.27 | 21.91 | 10 | | |
| 50419 | 5 | 57 | 10 | 10 | 24.23 | 23.2 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50419 | 6 | 121 | 10 | 10 | 24.88 | 23.39 | 10 | | |
| 50419 | 7 | 62 | 10 | 9 | 24.97 | 23.63 | 9 | | |
| 50419 | 8 | 79 | 10 | 10 | 24.04 | 22.5 | 10 | | |
| 50420 | 1 | 9 | 10 | 9 | 24.29 | 22.72 | 9 | | |
| 50420 | 2 | 10 | 10 | 9 | 24.81 | 23.78 | 9 | | |
| 50420 | 3 | 5 | 10 | 10 | 25.35 | 23.9 | 10 | | |
| 50420 | 4 | 54 | 10 | 10 | 23.78 | 22.45 | 10 | | |
| 50420 | 5 | 91 | 10 | 10 | 24.63 | 23.14 | 10 | | |
| 50420 | 6 | 28 | 10 | 10 | 26.24 | 24.51 | 10 | | |
| 50420 | 7 | 6 | 10 | 9 | 22.9 | 21.68 | 9 | | |
| 50420 | 8 | 86 | 11 | 11 | 27.94 | 26.21 | 11 | | |
| 50421 | 1 | 81 | 10 | 10 | 23.94 | 22.71 | 10 | | |
| 50421 | 2 | 37 | 10 | 10 | 24.16 | 22.97 | 10 | | |
| 50421 | 3 | 89 | 10 | 8 | 23.59 | 22.58 | 8 | | |
| 50421 | 4 | 21 | 10 | 7 | 26.01 | 24.81 | 7 | | |
| 50421 | 5 | 2 | 10 | 10 | 24.91 | 23.5 | 10 | | |
| 50421 | 6 | 78 | 10 | 10 | 24.23 | 22.97 | 10 | | |
| 50421 | 7 | 125 | 10 | 10 | 25.57 | 24.43 | 10 | | |
| 50421 | 8 | 60 | 10 | 10 | 25.11 | 23.79 | 10 | | |
| 50422 | 1 | 61 | 10 | 9 | 23.17 | 22.2 | 9 | | |
| 50422 | 2 | 67 | 10 | 10 | 25.72 | 24.25 | 10 | | |
| 50422 | 3 | 124 | 10 | 7 | 24.59 | 23.05 | 7 | | |
| 50422 | 4 | 4 | 10 | 10 | 24.1 | 22.82 | 10 | | |
| 50422 | 5 | 40 | 10 | 10 | 26.46 | 24.8 | 10 | | |
| 50422 | 6 | 92 | 10 | 9 | 24.75 | 23.55 | 9 | | |
| 50422 | 7 | 117 | 10 | 10 | 24.48 | 22.83 | 10 | | |
| 50422 | 8 | 33 | 10 | 10 | 24.69 | 23.48 | 10 | | |
| 50423 | 1 | 126 | 10 | 9 | 23.64 | 22.67 | 8 | | |
| 50423 | 2 | 14 | 10 | 9 | 25.33 | 24.19 | 9 | | |
| 50423 | 3 | 82 | 11 | 11 | 24.46 | 23.47 | 11 | | |
| 50423 | 4 | 110 | 10 | 9 | 25.27 | 23.76 | 9 | | |
| 50423 | 5 | 127 | 10 | 10 | 25.38 | 23.91 | 10 | | |
| 50423 | 6 | 104 | 10 | 10 | 22.79 | 21.63 | 10 | | |
| 50423 | 7 | 119 | 10 | 9 | 23.8 | 22.44 | 9 | | |
| 50423 | 8 | 63 | 10 | 10 | 24.53 | 23.28 | 10 | | |
| 50424 | 1 | 103 | 10 | 9 | 23.04 | 21.9 | 9 | | |
| 50424 | 2 | 7 | 10 | 10 | 23.67 | 22.04 | 10 | | |
| 50424 | 3 | 66 | 10 | 10 | 23.34 | 22.24 | 10 | | |
| 50424 | 4 | 51 | 10 | 10 | 24.56 | 23.12 | 10 | | |
| 50424 | 5 | 94 | 10 | 10 | 24.84 | 23.27 | 10 | | |
| 50424 | 6 | 93 | 10 | 9 | 23.87 | 22.86 | 9 | | |
| 50424 | 7 | 44 | 10 | 10 | 24.69 | 23.19 | 10 | | |
| 50424 | 8 | 16 | 10 | 9 | 24.05 | 22.88 | 9 | | |
| 50425 | 1 | 18 | 10 | 8 | 24.5 | 23.17 | 8 | | |
| 50425 | 2 | 39 | 10 | 10 | 23.31 | 21.76 | 10 | | |
| 50425 | 3 | 72 | 10 | 10 | 24.12 | 22.73 | 10 | | |
| 50425 | 4 | 48 | 10 | 10 | 23.22 | 21.63 | 10 | | |
| 50425 | 5 | 42 | 10 | 10 | 25.86 | 24.63 | 10 | | |
| 50425 | 6 | 20 | 10 | 9 | 23.13 | 22.91 | 9 | | |
| 50425 | 7 | 76 | 10 | 9 | 25.38 | 23.97 | 9 | | |

| Group | Rep | Pos | # Exposed | # Survived | Total Weight-mg | Tare Weight-mg | Pan Count | Mean Length-mm | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 50425 | 8 | 22 | 10 | 9 | 26.9 | 24.4 | 9 | | |
| 50426 | 1 | 24 | 10 | 9 | 25.12 | 23.93 | 9 | | |
| 50426 | 2 | 108 | 10 | 9 | 24.84 | 23.47 | 9 | | |
| 50426 | 3 | 70 | 10 | 10 | 25.04 | 23.82 | 10 | | |
| 50426 | 4 | 32 | 10 | 9 | 25.87 | 24.56 | 9 | | |
| 50426 | 5 | 100 | 10 | 9 | 23.83 | 22.39 | 9 | | |
| 50426 | 6 | 113 | 10 | 10 | 24.8 | 23.15 | 10 | | |
| 50426 | 7 | 65 | 10 | 10 | 24.74 | 22.93 | 10 | | |
| 50426 | 8 | 77 | 10 | 10 | 23.83 | 22.43 | 10 | | |
| 50427 | 1 | 101 | 10 | 10 | 24.83 | 23.55 | 10 | | |
| 50427 | 2 | 115 | 10 | 10 | 25.06 | 23.87 | 10 | | |
| 50427 | 3 | 27 | 10 | 10 | 23.27 | 21.7 | 10 | | |
| 50427 | 4 | 116 | 10 | 10 | 24.39 | 23.28 | 10 | | |
| 50427 | 5 | 19 | 10 | 10 | 24.48 | 23.3 | 10 | | |
| 50427 | 6 | 84 | 10 | 10 | 24.11 | 22.72 | 10 | | |
| 50427 | 7 | 45 | 10 | 9 | 25.14 | 23.69 | 9 | | |
| 50427 | 8 | 98 | 10 | 10 | 24.12 | 22.94 | 10 | | |
| 50428 | 1 | 29 | 10 | 10 | 24.98 | 23.79 | 9 | | |
| 50428 | 2 | 83 | 10 | 10 | 26.1 | 24.21 | 10 | | |
| 50428 | 3 | 15 | 10 | 10 | 24.77 | 23.52 | 9 | | |
| 50428 | 4 | 99 | 10 | 9 | 23.63 | 22.42 | 9 | | |
| 50428 | 5 | 34 | 10 | 9 | 24.89 | 23.59 | 9 | | |
| 50428 | 6 | 56 | 10 | 10 | 25.09 | 23.64 | 9 | | |
| 50428 | 7 | 74 | 10 | 10 | 23.04 | 21.59 | 10 | | |
| 50428 | 8 | 64 | 10 | 7 | 25.46 | 24.66 | 7 | | |
| 50429 | 1 | 12 | 10 | 10 | 23.63 | 22.31 | 10 | | |
| 50429 | 2 | 17 | 10 | 10 | 29.23 | 27.73 | 10 | | |
| 50429 | 3 | 118 | 10 | 10 | 25.02 | 23.43 | 10 | | |
| 50429 | 4 | 50 | 10 | 9 | 24.91 | 23.68 | 8 | | |
| 50429 | 5 | 41 | 10 | 9 | 25.29 | 23.82 | 9 | | |
| 50429 | 6 | 49 | 10 | 9 | 25.27 | 24.11 | 9 | | |
| 50429 | 7 | 71 | 10 | 10 | 22.75 | 21.8 | 10 | | |
| 50429 | 8 | 23 | 10 | 10 | 24.32 | 22.72 | 10 | | |

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Number Surviving | Initials | Re-Pick | Initials | Total Surviving | Number Weighed | Initial Weight | Final Weight |
|---|---|---|---|---|---|---|---|---|---|
| **50413** CONTROL | A | 9 | JW | – | – | 9 | 9 | 23.99 | 25.16 |
| | B | 10 | JW | – | – | 10 | 10 | 22.98 | 24.54 |
| | C | 10 | KP | – | – | 10 | 10 | 26.05 | 27.59 |
| | D | 8 | JW | – | – | 8 | 8 | 22.98 | 24.58 |
| | E | 10 | JW | – | – | 10 | 10 | 24.66 | 26.10 |
| | F | 10 | KP | – | – | 10 | 10 | 23.83 | 25.65 |
| | G | 9 | KP | – | – | 9 | 9 | 23.93 | 25.54 |
| | H | ① ~~9~~ 10 | JW | – | – | ~~9~~ 10 | 10 | 23.85 | 25.32 |
| **50415** SED6C00EN | A | 9 | JW | – | – | 9 | 9 | 22.02 | 23.34 |
| | B | 10 | KP | – | – | 10 | 10 | 24.26 | 26.10 |
| | C | 10 | KP | – | – | 10 | 10 | 23.65 | 25.07 |
| | D | 10 | JW | – | – | 10 | 10 | 24.48 | 25.77 |
| | E | 9 | KN | – | – | 9 | 9 | 22.52 | 23.64 |
| | F | 10 | KN | – | – | 10 | 10 | 23.16 | 24.40 |
| | G | 9 | KP | – | – | 9 | 9 | 25.35 | 26.58 |
| | H | 10 | KP | – | – | 10 | 10 | 23.61 | ~~25.10~~ 25.06 |
| **50416** SED8C00EN | A | 10 | KN | – | – | 10 | 10 | 22.91 | 24.40 |
| | B | 9 | KP | – | – | 9 | 9 | 23.74 | 24.87 |
| | C | 10 | JW | – | – | 10 | 10 | 23.66 | 24.82 |
| | D | 10 | EB | – | – | 10 | 10 | 23.03 | 24.62 |
| correction JW → | E | ~~9~~ 10 | JW | – | – | ~~9~~ 10 | 10 | 23.89 | 25.24 |
| | F | 9 | JW | – | – | 9 | 9 | 21.88 | 23.17 |
| | G | 10 | KN | – | – | 10 | 10 | 24.03 | 25.30 |
| | H | 10 | EB | – | – | 10 | 10 | 23.50 | 25.07 |
| **50417** SED7B00EN ② | A | 10 | EB | – | – | 10 | 10 | 25.09 | 26.02 |
| | B | 10 | EB | – | – | 10 | 10 | 23.80 | 25.21 |
| | C | ~~10~~ 8 EB | ~~JW~~ EB | – | – | 8 ~~10~~ | 8 | 23.81 | 24.97 |
| | D | 9 | EB | – | – | 9 | 9 | 23.00 | 24.18 |
| | E | 9 | JW | – | – | 9 | 9 | 24.24 | 25.62 |
| | F | 9 | KN | – | – | 9 | 9 | 23.60 | 24.68 |
| | G | 8 | KN | – | – | 8 | 8 | 23.56 | 24.49 |
| | H | 9 | KN | – | – | 9 | 9 | 24.29 | 25.33 |

NOTES: ① Found 10th amphipod JW 8/3/17
② Wrote # in wrong location JW 8/7/17

Date/Init (Initial Weights): 8/3/17 KN
IN (Date/Time/Temp/Init): 8/7/17 17:45 81°C KN
OUT (Date/Time/Temp/Init): 8/8/17 14:16 88 °C EB



**Aquatec Environmental, Inc.**

Reviewed by: JW Date: 8/28/17

SDG: 15151
Project 17022

**100.1** **Amphipod, H. azteca, 10-D Survival and Growth Test for Sedime**

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Number Surviving | Initials | Re-Pick | Initials | Total Surviving | Number Weighed | Initial Weight | Final Weight |
|---|---|---|---|---|---|---|---|---|---|
| **50418** | A | 10 | EB | - | - | 10 | 10 | 24.15 | 25.27 |
| | B | 8 | EB | - | - | 8 | 8 | 22.51 | 23.73 |
| SED7F00EN | C | 10 | JW | - | - | 10 | 10 | 23.01 | 24.42 |
| | D | 10 | KN | - | - | 10 | 10 | 22.91 | 24.40 |
| | E | 10 | JW | - | - | 10 | 10 | 22.85 | 24.40 |
| | F | 10 | KN | - | - | 10 | 10 | 23.70 | 25.19 |
| | G | 10 | KN | - | - | 10 | 10 | 25.47 | 26.56 |
| | H | 9 | KN | - | - | 9 | 9 | 23.68 | 25.08 |
| **50419** | A | 10 | EB | - | - | 10 | 10 | 23.47 | 24.88 |
| | B | 10 | EB | - | - | 10 | 10 | 23.02 | 24.25 |
| SED7.5E00EN | C | 10 | EB | - | - | 10 | 10 | 23.56 | 24.80 |
| | D | 10 | KN | - | - | 10 | 10 | 21.91 | 23.27 |
| | E | 10 | JW | - | - | 10 | 9 | 23.20 | 24.23 |
| | F | 10 | KN | - | - | 10 | 10 | 23.39 | 24.88 |
| | G | 9 | JW | - | - | 9 | 9 | 23.63 | 24.97 |
| | H | 10 | KN | - | - | 10 | 10 | 22.50 | 24.04 |
| **50420** | A | 9 | EB | - | - | 9 | 9 | 22.72 | 24.29 |
| | B | 9 | KN | - | - | KN 9 | 9 | 23.78 | 24.81 |
| SED6.5E00EN | C | 10 | JW | - | - | 10 | 10 | 23.90 | 25.35 |
| | D | 10 | EB | - | - | 10 | 10 | 22.45 | 23.78 |
| | E | 10 | JW | - | - | 10 | 10 | 23.14 | 24.63 |
| | F | 10 | KP | - | - | 10 | 10 | 24.51 | 26.24 |
| | G | 9 | KP | - | - | 9 | 9 | 21.68 | 22.90 |
| | H | 11 | KN | - | - | 11 | 11 | 26.21 | 27.94 |
| **50421** | A | 10 | JW | - | - | 10 | 10 | 22.71 | 23.94 |
| | B | 10 | JW | - | - | 10 | 10 | 22.97 | 24.16 |
| SED7E00EN | C | 8 | KP | - | - | 8 | 8 | 22.58 | 23.59 |
| | D | 7 | KP | 0 | JW | 7 | 7 | 24.81 | 26.01 |
| | E | 10 | EB | - | - | 10 | 10 | 23.50 | 24.91 |
| | F | 10 | EB | - | - | 10 | 10 | 22.97 | 24.23 |
| | G | 10 | KP | - | - | 10 | 10 | 24.43 | 25.57 |
| | H | 10 | KP | - | - | 10 | 10 | 23.79 | 25.11 |

NOTES:

Date/Init (Initial Weights): 8/3/17 KN

IN (Date/Time/Temp/Init): 8/7/17 17:45 81°C KN

OUT (Date/Time/Temp/Init): 8/8/17 14:30 88°C EB



**Aquatec Environmental, Inc.**

Reviewed by: JW Date: 8/25/17.

**SDG:** 15151

**Project** 17022

**100.1** **Amphipod, H. azteca, 10-D Survival and Growth Test for Sedime**

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy

**SEDIMENT TEST DATA:**

| Sample Number | REP | Number Surviving | Initials | Re-Pick | Initials | Total Surviving | Number Weighed | Initial Weight | Final Weight |
|---|---|---|---|---|---|---|---|---|---|
| **50422** | A | 9 | KP | — | — | 9 | 9 | 22.20 | 23.17 |
| | B | 10 | KP | — | — | 10 | 10 | 24.25 | 25.72 |
| SED6B00EN | C | 7 | EB | 0 | ow | 7 | 7 | 23.05 | 24.59 |
| | D | 10 | KP | — | — | 10 | 10 | 22.82 | 24.10 |
| | E | 10 | KP | — | — | 10 | 10 | 24.80 | 26.46 |
| | F | 9 | ow | — | — | 9 | 9 | 23.55 | 24.75 |
| | G | 10 | EB | — | — | 10 | 10 | 22.83 | 24.48 |
| | H | 10 | ow | — | — | 10 | 10 | 23.48 | 24.69 |
| **50423** | A | 9 | KP | — | — | 9 | 8 | 22.67 | 23.64 |
| | B | 9 | KP | — | — | 9 | 9 | 24.19 | 25.33 |
| SED6A00EN | C | 11 ① | ow | — | — | 11 | 11 | 23.47 | 24.46 |
| | D | 9 | KP | — | — | 9 | 9 | 23.76 | 25.27 |
| | E | 10 | ow | — | — | 10 | 10 | 23.91 | 25.38 |
| | F | 10 | KP | — | — | 10 | 10 | 21.63 | 22.79 |
| | G | 9 | KP | — | — | 9 | 9 | 22.44 | 23.80 |
| | H | 10 | KP | — | — | 10 | 10 | 23.28 | 24.53 |
| **50424** | A | 9 | ow | — | — | 9 | 9 | 21.90 | 23.04 |
| | B | 10 | EB | — | — | 10 | 10 | 22.04 | 23.67 |
| SED7.5D00EN | C | 10 | EB | — | — | 10 | 10 | 22.24 | 23.34 |
| | D | 10 | EB | — | — | 10 | 10 | 23.12 | 24.56 |
| | E | 10 | EB | — | — | 10 | 10 | 23.27 | 24.84 |
| | F | 9 | ow | — | — | 9 | 9 | 22.86 | 23.87 |
| | G | 10 | KP | — | — | 10 | 10 | 23.19 | 24.69 |
| | H | 9 | KP | — | — | 9 | 9 | 22.88 | 24.05 |
| **50425** | A | 8 | KP | — | — | 8 | 8 | 23.17 | 24.50 |
| | B | 10 | KP | — | — | 10 | 10 | 21.76 | 23.31 |
| SED7D00EN | C | 10 | KP | — | — | 10 | 10 | 22.73 | 24.12 |
| | D | 10 | KP | — | — | 10 | 10 | 21.63 | 23.22 |
| | E | 10 | EB | — | — | 10 | 10 | 24.63 | 25.86 |
| | F | 9 | EB | — | — | 9 | 9 | 22.91 | 23.13 |
| | G | 9 | ow | — | — | 9 | 9 | 23.97 | 25.38 |
| | H | 9 | ow | — | — | 9 | 9 | 24.40 | 26.90 |

NOTES: ① Two are very small - look to be neonates. ow

Date/Init (Initial Weights): 8/3/17 KN

IN (Date/Time/Temp/Init): 8/7/17 17:45 81°C KN

OUT (Date/Time/Temp/Init): 8/8/17 15:10 88° EB



**Aquatec Environmental, Inc.**

Reviewed by: ow Date: 8/25/17

**SDG:** 15151

**Project** 17022

**100.1** # Amphipod, H. azteca, 10-D Survival and Growth Test for Sedime

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Number Surviving | Initials | Re-Pick | Initials | Total Surviving | Number Weighed | Initial Weight | Final Weight |
|---|---|---|---|---|---|---|---|---|---|
| **50426** | A | 9 | KP | — | — | 9 | 9 | 23.93 | 25.12 |
| SED6.5D00EN | B | 9 | KP | — | — | 9 | 9 | 23.47 | 24.84 |
| | C | 10 | KP | — | — | 10 | 10 | 23.82 | 25.04 |
| | D | 9 | JW | — | — | 9 | 9 | 24.56 | 25.87 |
| | E | 9 | KP | — | — | 9 | 9 | 22.39 | 23.83 |
| | F | 10 | KP | — | — | 10 | 10 | 23.15 | 24.80 |
| | G | 10 | JW | — | — | 10 | 10 | 22.93 | 24.74 |
| | H | 10 | KP | — | — | 10 | 10 | 22.43 | 23.83 |
| **50427** | A | 10 | EB | — | — | 10 | 10 | 23.55 | 24.83 |
| SED8A00EN | B | 10 | KP | — | — | 10 | 10 | 23.87 | 25.06 |
| | C | 10 | KP | — | — | 10 | 10 | 21.70 | 23.27 |
| | D | 10 | EB | — | — | 10 | 10 | 23.28 | 24.39 |
| | E | 10 | JW | — | — | 10 | 10 | 23.30 | 24.48 |
| | F | 10 | JW | — | — | 10 | 10 | 22.72 | 24.11 |
| | G | 9 | EB | — | — | 9 | 9 | 23.69 | 25.14 |
| | H | 10 | EB | — | — | 10 | 10 | 22.94 | 24.12 |
| **50428** | A | 10 | JW | — | — | 10 | 9 | 23.79 | 24.98 |
| SED7A00EN | B | 10 | KP | — | — | 10 | 10 | 24.21 | 26.10 |
| | C | 10 | KP | — | — | 10 | 9 | 23.52 | 24.77 |
| | D | 9 | KP | — | — | 9 | 9 | 22.42 | 23.63 |
| | E | 9 | KP | — | — | 9 | 9 | 23.59 | 24.89 |
| | F | 10 | JW | — | — | 10 | 9 | 23.64 | 25.09 |
| | G | ~~9~~ 10 | EB | — | — | 10 | 10 | 21.59 | 23.04 |
| | H | 7 | JW | 0 | KP | 7 | 7 | 24.66 | 25.46 |
| **50429** | A | 10 | KP | — | — | 10 | 10 | 22.31 | 23.63 |
| SED8B00EN | B | 10 | KP | — | — | 10 | 10 | 27.73 | 29.23 |
| | C | 10 | EB | — | — | 10 | 10 | 23.43 | 25.02 |
| | D | 9 | JW | — | — | 9 | 8 | 23.68 | 24.91 |
| | E | 9 | JW | — | — | 9 | 9 | 23.82 | 25.29 |
| | F | 9 | KP | — | — | 9 | 9 | 24.11 | 25.27 |
| | G | 10 | JW | — | — | 10 | 10 | 21.80 | 22.75 |
| | H | 10 | KP | — | — | 10 | 10 | 22.72 | 24.32 |

NOTES:

Date/Init (Initial Weights): 8/3/17 KN

IN (Date/Time/Temp/Init): 8/7/17 17:45 KN 81°C

OUT (Date/Time/Temp/Init): 8/8/17 15:30 88°C EB



**Aquatec Environmental, Inc.**

Reviewed by: JW Date: 8/25/17

**SDG:** 15151

**Project** 17022

## 100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sedime

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy

### SEDIMENT TEST DATA:

| Sample Number | REP | Number Surviving | Initials | Re-Pick | Initials | Total Surviving | Number Weighed | Initial Weight | Final Weight |
|---|---|---|---|---|---|---|---|---|---|
| **50430** SEDBACK1600N | A | 9 | EB | — | — | 9 | 9 | 24.06 | 25.09 |
| | B | 6 | EB | 0 | JW | 6 | 6 | 22.90 | 23.~~99~~64 |
| | C | 9 | JW | — | — | 9 | 9 | 22.85 | 23.94 |
| | D | 8 | JW | — | — | 8 | 8 | 23.33 | 24.48 |
| | E | 9 | JW | — | — | 9 | 9 | 22.83 | 23.59 |
| | F | 9 | JW | — | — | 9 | 9 | 22.92 | 23.77 |
| | G | 7 | KP | 0 | KN | 7 | 7 | 24.10 | 24.97 |
| | H | 10 | KP | — | — | 10 | 10 | 23.73 | 24.85 |
| **50431** SEDBACK1700N | A | 9 | JW | — | — | 9 | 9 | 23.62 | 24.79 |
| | B | 10 | KP | — | — | 10 | 10 | 26.59 | 28.14 |
| | C | 10 | JW | — | — | 10 | 10 | 23.56 | 24.86 |
| | D | 10 | JW | — | — | 10 | 10 | 24.27 | 25.87 |
| | E | 10 | JW | — | — | 10 | 10 | 23.76 | 25.16 |
| | F | 10 | KP | — | — | 10 | 10 | 23.75 | 25.59 |
| | G | 10 | KP | — | — | 10 | 10 | 24.44 | 26.32 |
| | H | 8 | KP | — | — | 8 | 8 | 25.30 | 26.21 |
| **50432** SEDBACK1800N | A | 9 | EB | — | — | 9 | 9 | 22.94 | 24.24 |
| | B | 9 | JW | — | — | 9 | 9 | 25.24 | 26.74 |
| | C | 10 | KP | — | — | 10 | 10 | 23.91 | 25.49 |
| | D | 10 | KP | — | — | 10 | 10 | 22.39 | 23.65 |
| | E | 10 | JW | — | — | 10 | 9 | 23.80 | 24.84 |
| | F | 10 | JW | — | — | 10 | 10 | 23.07 | 24.77 |
| | G | 10 | JW | — | — | 10 | 10 | 22.65 | 23.99 |
| | H | 11 | JW | — | — | 11 | 11 | 23.14 | 24.81 |
| **50433** SEDBACK1900N | A | 10 | KP | — | — | 10 | 10 | 23.75 | 25.29 |
| | B | 10 | KP | — | — | 10 | 10 | 22.76 | 24.37 |
| | C | 10 | JW | — | — | 10 | 10 | 22.68 | 24.29 |
| | D | 9 | EB | — | — | 9 | 9 | 22.48 | 23.34 |
| | E | 10 | JW | — | — | 10 | 10 | 23.77 | 25.10 |
| | F | 9 | JW | — | — | 9 | 9 | 23.92 | 25.09 |
| | G | 10 | KP | — | — | 10 | 10 | 24.08 | 25.68 |
| | H | 10 | KP | — | — | 10 | 10 | 23.59 | 25.10 |

NOTES:

Date/Init (Initial Weights): 8/3/17 KN

IN (Date/Time/Temp/Init): 8/7/17 1745 KN 81°C

OUT (Date/Time/Temp/Init): 8/8/17 15:45 88°C EB



**Aquatec Environmental, Inc.**

Reviewed by: JW Date: 8/25/17

**SDG:** 15151
**Project** 17022

**Client ID:** AECOM/Kennedy

## SEDIMENT TEST DATA:

| Sample Number | REP | Number Surviving | Initials | Re-Pick | Initials | Total Surviving | Number Weighed | Initial Weight | Final Weight |
|---|---|---|---|---|---|---|---|---|---|
| **50434** | A | 9 | a | — | — | 9 | ① 8 | 22.71 | 23.85 |
| | B | 9 | KP | — | — | 9 | 9 | 22.73 | 24.17 |
| SEDBACK2000N | C | 9 | KP | — | — | 9 | 9 | 22.92 | 24.23 |
| | D | 9 | EB | — | — | 9 | 9 | 21.80 | 23.29 |
| | E | 8 | a | — | — | 8 | 8 | 23.86 | 25.28 |
| | F | 9 | a | — | — | 9 | 9 | 23.65 | 24.90 |
| | G | 10 | KP | — | — | 10 | 10 | 23.47 | 24.96 |
| | H | 10 | KP | — | — | 10 | 10 | 22.90 | 24.40 |

NOTES: ① one molt present possible miscount

Date/Init (Initial Weights): 8/3/17 KN
IN (Date/Time/Temp/Init): 8/7/17 17:45 81°C KN
OUT (Date/Time/Temp/Init): 8/8/17 15:45 88°C EB



**Aquatec Environmental, Inc.**
Reviewed by: ON Date: 9/9/17

**SDG:** 15151
**Project** 17022

# Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960


AECOM
250 Apollo Drive

Chelmsford, MA 01824

**Tel:** (978) 905-2269
**E-Mail:** robert.kennedy@aecom.com

**Client ID:** AECOM/Kennedy

## ORGANISM HOLDING AND ACCLIMATION

Species: *Hyalella azteca*
Supplier: ARO
Conditio Normal

Date Received: 7/27/17
Age of Organism 11 d
Culture ID: 072717

Acclimation / Holding Procedures: Transfer to holding culture boxes, add laboratory water. Acclimate to water to be used for testing (sediment overlying water formulation). Aerate lightly. Water change at least once (50 %) every two days.
Daily Feeding: 1:1 mix of Selenastrum / YCT, 1-3 mL (Maintain hint of green algal coloration on culture box bottom). Also add a pinch of ground Tetrafin. Do not allow excess food to accumulate.

| Date | Fed | Temp. | pH | D.O. | Cond. | Condition | Water Change | Initials |
|---|---|---|---|---|---|---|---|---|
| 7/27/17 | ✓ | 21.9 | 6.8 | 7.0 | 399 | Normal/Active | | [illegible] |
| 7/28/17 | | 23.1 | 7.8 | 7.8 | 367 | | ✓ | |
| _/_/_ | | | | | | | TEST START 7/28/17 | [illegible] |
| _/_/_ | | | | | | | | |
| _/_/_ | | | | | | | | |

*N = Normal, appear healthy. Record # dead if any observed.*

### *Hyalella azteca* Initial Dry Weight

| Replicate | No. of Org. weighed | Initial Pan weight (mg) | Final Pan weight (mg) | Initial Average wt. (mg) |
|---|---|---|---|---|
| 1 | 10 | 22.79 | 23.26 | 0.057 |
| 2 | 10 | 24.37 | 24.76 | 0.039 |
| 3 | 10 | 24.80 | 25.24 | 0.044 |
| 4 | 10 | 24.32 | 24.79 | 0.047 |
| 5 | 10 | 24.73 | 25.17 | 0.044 |
| 6 | 10 | 23.60 | 24.02 | 0.042 |
| 7 | 10 | 23.47 | 23.92 | 0.045 |
| 8 | 10 | 25.91 | 26.34 | 0.043 |
| | Initials | KN | KP | |
| | Date | 7/28/17 | 7.29.17 | overall avg. wt. 0.044 |

overall avg. wt. 0.044 / amphipod.

**IN/OUT of Oven:**

| IN: Date/Time/Initials/Temp. |
|---|
| 7/28/17 15:20 71°C KN |
| **OUT: Date/Time/Initials/Temp.** |
| 7.29.17 1550 71°C KP |

**Aquatic Research Organisms**

## DATA SHEET

### I. Organism History

Species ______________________

Source: Lab reared ______ Hatchery reared ______ Field collected ______

Hatch date ______ Receipt date ______

Lot number ______ Strain ______

Brood origination ______

### II. Water Quality

Temperature ______ °C Salinity ______ ppt D.O. ______ ppm

pH ______ su Hardness ______ ppm Alkalinity ______ ppm

### III. Culture Conditions

Freshwater ______ Saltwater ______ Other ______

Recirculating ______ Flow through ______ Static renewal ______

**DIET:** Flake food ______ Phytoplankton ______ Trout chow ______

Artemia ______ Rotifers ______ YCT ______ Other ______

Prophylactic treatments: ______

Comments: ______

______

### IV. Shipping Information

Client: ______ # of Organisms ______

Carrier: ______ Date shipped ______

Biologist: ______

Rec. 7/27/17

Temp 21.9
pH 6.8
D.O. 7.0
Conductivity 399 µS

Condition
Normal/Active

Fed YCT
Added mesh substrate.

PO BOX 1271 HAMPTON NH 03843-1271 (603) 926-1650 AROFISH@AOL.COM

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy

## CHEMISTRY MONITORING:



| Sample | Analysis | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **50413** CONTROL | pH | 7.4 | | | | | | | | | 7.6 | |
| | DO | 6.4 | 6.6 | 7.6 | 7.0 | 6.5 | 6.2 | 7.0 | 6.7 | 6.1 | 6.6 | 6.2 |
| | Cond. | 349 | | | | | | | | | 340 | |
| **50415** SED6C00EN | pH | 7.4 | | | | | | | | | 7.4 | |
| | DO | 6.0 | 5.3 | 7.0 | 6.1 | 5.6 | 5.6 | 6.3 | 6.3 | 5.9 | 6.4 | 4.7 |
| | Cond. | 396 | | | | | | | | | 355 | |
| **50416** SED8C00EN | pH | 7.3 | | | | | | | | | 7.4 | |
| | DO | 5.8 | 5.5 | 6.5 | 6.2 | 6.0 | 5.9 | 6.6 | 5.8 | 5.2 | 6.3 | 4.8 |
| | Cond. | 389 | | | | | | | | | 355 | |
| **50417** SED7B00EN | pH | 7.4 | | | | | | | | | 7.4 | |
| | DO | 6.7 | 5.2 | 6.3 | 6.0 | 6.0 | 6.1 | 6.3 | 5.8 | 5.3 | 5.8 | 4.8 |
| | Cond. | 399 | | | | | | | | | 360 | |
| **50418** SED7F00EN | pH | 7.4 | | | | | | | | | 7.4 | |
| | DO | 6.2 | 5.7 | 6.6 | 6.1 | 6.3 | 6.1 | 6.2 | 6.7 | 5.2 | 5.8 | 4.6 |
| | Cond. | 394 | | | | | | | | | 365 | |
| **50419** SED7.5E00EN | pH | 7.3 | | | | | | | | | 7.7 | |
| | DO | 6.1 | 5.8 | 6.6 | 6.1 | 5.7 | 5.5 | 6.2 | 5.8 | 4.9 | 6.2 | 4.8 |
| | Cond. | 388 | | | | | | | | | 369 | |
| **50420** SED6.5E00EN | pH | 7.4 | | | | | | | | | 7.6 | |
| | DO | 6.1 | 5.5 | 6.5 | 6.2 | 6.2 | 5.5 | 6.5 | 6.0 | 4.7 | 6.1 | 4.2 |
| | Cond. | 398 | | | | | | | | | 369 | |
| **50421** SED7E00EN | pH | 7.4 | | | | | | | | | 7.5 | |
| | DO | 5.8 | 5.7 | 6.9 | 6.2 | 6.4 | 5.5 | 6.1 | 6.0 | 4.6 | 5.9 | 4.6 |
| | Cond. | 399 | | | | | | | | | 372 | |
| **50422** SED6B00EN | pH | 7.5 | | | | | | | | | 7.5 | |
| | DO | 5.6 | 5.7 | 6.5 | 6.1 | 6.1 | 5.4 | 6.2 | 5.9 | 5.1 | 5.9 | 3.8 |
| | Cond. | 416 | | | | | | | | | 362 | |
| **50423** SED6A00EN | pH | 7.3 | | | | | | | | | 7.3 | |
| | DO | 6.4 | 5.7 | 6.6 | 6.2 | 6.1 | 5.8 | 6.4 | 6.0 | 5.3 | 6.0 | 4.5 |
| | Cond. | 439 | | | | | | | | | 353 | |
| **50424** SED7.5D00EN | pH | 7.3 | | | | | | | | | 7.4 | |
| | DO | 6.1 | 5.9 | 6.7 | 6.6 | 6.3 | 5.6 | 6.3 | 5.8 | 4.9 | 6.0 | 4.8 |
| | Cond. | 381 | | | | | | | | | 366 | |

*Chemical analysis Date/Initials are noted on last page of Days 0 - 10 chemistry data sheets*

# Amphipod, H. azteca, 10-D Survival and Growth Test for Sedime

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy

**CHEMISTRY MONITORING:** 

| Sample | Analysis | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50425 SED7D00EN | pH | 7.3 | | | | | | | | | 7.6 | |
| | DO | 6.4 | 5.9 | 6.9 | 6.2 | 6.2 | 6.0 | 6.9 | 6.1 | 5.1 | 6.0 | ~~6.2~~ 5.0 σ |
| | Cond. | 380 | | | | | | | | | 369 | |
| 50426 SED6.5D00EN | pH | 7.3 | | | | | | | | | 7.6 | |
| | DO | 5.9 | 5.8 | 6.7 | 6.3 | 6.0 | 5.7 | 6.5 | 5.9 | 4.8 | 6.0 | 4.8 |
| | Cond. | 405 | | | | | | | | | 361 | |
| 50427 SED8A00EN | pH | 7.2 | | | | | | | | | 7.4 | |
| | DO | 5.9 | 5.9 | 7.4 | 6.0 | 6.2 | 5.8 | 5.9 | 6.8 | 5.2 | 5.7 | 5.4 |
| | Cond. | 392 | | | | | | | | | 355 | |
| 50428 SED7A00EN | pH | 7.4 | | | | | | | | | 7.2 | |
| | DO | 6.9 | 5.4 | 6.5 | 6.0 | 6.8 | 6.3 | 6.8 | 6.3 | 5.1 | 5.8 | 3.8 |
| | Cond. | 414 | | | | | | | | | 375 | |
| 50429 SED8B00EN | pH | 7.4 | | | | | | | | | 7.2 | |
| | DO | 5.6 | 4.7 | 6.6 | 6.0 | 7.0 | 5.4 | 6.3 | 6.7 | 5.2 | 6.0 | 3.9 |
| | Cond. | 416 | | | | | | | | | 370 | |
| 50430 SEDBACK160 ON | pH | 7.3 | | | | | | | | | 7.3 | |
| | DO | 6.5 | 5.3 | 6.5 | 6.1 | 6.6 | 5.4 | 6.6 | 6.3 | 4.3 | 5.9 | 3.3 |
| | Cond. | 432 | | | | | | | | | 356 | |
| 50431 SEDBACK170 ON | pH | 7.2 | | | | | | | | | 7.2 | |
| | DO | 6.1 | 5.8 | 6.8 | 6.1 | 6.7 | 5.9 | 6.6 | 5.9 | 4.0 | 5.6 | 3.5 |
| | Cond. | 429 | | | | | | | | | σ ~~356~~ 362 | |
| 50432 SEDBACK180 ON | pH | 7.4 | | | | | | | | | 7.4 | |
| | DO | 5.3 | 5.5 | 6.7 | 6.3 | 7.2 | 5.5 | 6.5 | 6.2 | 5.2 | 5.5 | 3.6 |
| | Cond. | 423 | | | | | | | | | 367 | |
| 50433 SEDBACK190 ON | pH | 7.5 | | | | | | | | | 7.4 | |
| | DO | 6.2 | 5.9 | 6.5 | 6.2 | 6.9 | 5.7 | 5.6 | 6.1 | 4.8 | 5.7 | 4.0 |
| | Cond. | 446 | | | | | | | | | 355 | |
| 50434 SEDBACK200 ON | pH | 7.4 | | | | | | | | | 7.3 | |
| | DO | 6.8 | 5.7 | 7.0 | 6.2 | 7.1 | 5.7 | 6.6 | 6.1 | 5.6 | 5.7 | 5.6 |
| | Cond. | 432 | | | | | | | | | 353 | |
| 2017 | Date | 7/28 | 7/29 | 7/30 | 7/31 | 8/1 | 8/2 | 8/3 | 8/4 | 8/5 | 8/6 | |
| | Initials | KN | KP | KN | σ | EB | EB | KN | KN | KP | σ | |

*Chemical analysis Date/Initials are noted on last page of Days 0 - 10 chemistry data sheets*

**Aquatec Environmental, Inc.**

Reviewed by: σ Date: 9/9/17

**SDG:** 15151

**Project** 17022

Summary of temperature monitoring (°C)
*Hyalella azteca 10* -d survival and growth test (July 28-August 7, 2017)
Project: AECOM PEPCO BENNING

| Date | Day of Test | Cart 1 a.m | Cart 2 a.m | Cart 3 a.m | Cart 1 p.m. | Cart 2 p.m. | Cart 3 p.m. | °C Day average |
|---|---|---|---|---|---|---|---|---|
| 7/28/2017 | 0 | 22.9 | 22.8 | 22.4 | 23 | 22.7 | 22.3 | 22.7 |
| 7/29/2017 | 1 | 23.3 | 22.7 | 22.3 | 23.4 | 22.8 | 22.5 | 22.8 |
| 7/30/2017 | 2 | 23.5 | 22.8 | 22.4 | 23.4 | 22.6 | 22.4 | 22.9 |
| 7/31/2017 | 3 | 23.3 | 22.8 | 22.3 | 23.4 | 23.1 | 22.8 | 23.0 |
| 8/1/2017 | 4 | 23.3 | 23.2 | 23.1 | 23.3 | 23 | 23.1 | 23.2 |
| 8/2/2017 | 5 | 23.6 | 22.7 | 22.7 | 23.3 | 22.8 | 22.8 | 23.0 |
| 8/3/2017 | 6 | 23.4 | 23 | 23 | 23.8 | 23.7 | 23.7 | 23.4 |
| 8/4/2017 | 7 | 23.4 | 22.9 | 23 | 23.7 | 23.6 | 23.7 | 23.4 |
| 8/5/2017 | 8 | 23.5 | 23.2 | 23.3 | 23.2 | 23.1 | 23.3 | 23.3 |
| 8/6/2017 | 9 | 23.3 | 22.7 | 22.4 | 23.1 | 22.9 | 22.8 | 22.9 |
| 8/7/2017 | 10 | 23.2 | 22.7 | 22.5 | Not measured (test ended) | | | 22.8 |

| Cart 1 Avg. a.m. | Cart 2 Avg. a.m. | Cart 3 Avg. a.m. | Cart 1 Avg. p.m. | Cart 2 Avg. p.m. | Cart 3 Avg. p.m. |
|---|---|---|---|---|---|
| **23.3** | **22.9** | **22.7** | **23.4** | **23.0** | **22.9** |

| | |
|---|---|
| **Overall average temperature:** | **23.0** |
| **Average daily low:** | **22.7** |
| **Average daily high:** | **23.4** |

ov 9/11/17

**100.1** **Amphipod, H. azteca, 10-D Survival and Growth Test for Sedime**

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy **WEEK OF:** 7/23/17

**DAILY SEDIMENT MONITORING - CHECKLIST:** **ACTIVITY / DAY**

| AM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | | | | | | 22.9<br>22.8<br>22.4 | 23.3<br>22.7<br>22.3 |
| Fill Reservoirs | | | | | | ✓ | ✓ |
| Delivery tubes in place | | | | | | ✓ | ✓ |
| Check water Supply | | | | | | ✓ | ✓ |
| Empty Waste Buckets | | | | | | ✓ | ✓ |
| Floater/Aeration* Check | | | | | | — | ✓ |
| Chems Collected / ok? | | | | | | ✓ | ✓ |

| NOON | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Splitter box(s) filling? | | | | | | ✓ | ✓ |
| Syringes filing? | | | | | | ✓ | ✓ |
| Needles flowing? | | | | | | ✓ | ✓ |
| Drainage to Waste? | | | | | | ✓ | ✓ |
| Feeding (Time/Init.) | | | | | | 16:40 KN | 1225 KP |

| PM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | | | | | | 23.0<br>22.7<br>22.3 | 23.4<br>22.8<br>22.5 |
| Fill Reservoirs | | | | | | ✓ | ✓ |
| Delivery tubes in place | | | | | | ✓ | ✓ |
| Check water Supply | | | | | | ✓ | ✓ |
| Empty Waste Buckets | | | | | | ✓ | ✓ |
| Floater/Aeration* Check | | | | | | ✓ | ✓ |
| Date: | | | | | 7/27/17 | 7/28/17 | 7.29.17 |
| Initials: | | | | | [illegible] | KN | KP |

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| **Corrective Actions / Comments (Initial/Time)**<br>* Aeration required if DO is below/reaching minimum DO | | | | | Loaded sediments into test beakers. Added OLW Set up for midnight renewal [illegible] | Test start 14:40 JW | AM Renewal missed on Cart 1, delivery tubes were misplaced. Renewed first thing in AM |

**Aquatec Environmental, Inc.**
Reviewed by: [illegible] Date: 9/9/17

**SDG:** 15151
**Project** 17022

**100.1** **Amphipod, H. azteca, 10-D Survival and Growth Test for Sedime**

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: SED-A-001

**Client ID:** AECOM/Kennedy **WEEK OF:** 7/30/17

## DAILY SEDIMENT MONITORING - CHECKLIST:

**ACTIVITY / DAY**

| AM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | 23.5<br>23.3<br>22.4 | 23.3<br>22.8<br>22.3 | 23.3<br>23.2<br>23.1 | 23.6<br>22.7<br>22.7 | 23.4<br>23.0<br>23.0 | 23.4<br>22.9<br>23.0 | 23.5<br>23.2<br>23.3 |
| Fill Reservoirs | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Delivery tubes in place | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check water Supply | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Empty Waste Buckets | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Floater/Aeration* Check | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Chems Collected / ok? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| NOON | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Splitter box(s) filling? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Syringes filing? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Needles flowing? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Drainage to Waste? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Feeding (Time/Init.) | 12:40 KN | 1540 KN | 13:51 EB | 14:44 EB | 12:54 EB | 14:19 EB | 1440 KP |

| PM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | 23.4<br>22.6<br>22.4 | 23.4<br>23.1<br>22.8 | 23.3<br>23.0<br>23.1 | 23.3<br>22.8<br>22.8 | 23.8<br>23.7<br>23.7 | 23.7<br>23.6<br>23.7 | 23.2<br>23.1<br>23.3 |
| Fill Reservoirs | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Delivery tubes in place | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check water Supply | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Empty Waste Buckets | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Floater/Aeration* Check | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Date: | 7/30/17 | 7/31/17 | 8/1/17 | 8/2/17 | 8/3/17 | 8/4/17 | 8.5.17 |
| Initials: | KN | | KN | EB | KN/EB | KN/EB | KP |

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| **Corrective Actions / Comments (Initial/Time)**<br>* Aeration required if DO is below/reaching minimum DO | | | ~~Test start 13:00~~ 19:30 wrong data sheet | | | In beaker D.O. check 50422-4.7 50424-4.7 okay | |

**Aquatec Environmental, Inc.**

Reviewed by: Date: 9/9/17

SDG: 15151

Project 17022

Species: *Hyalella azteca* Reference: SOP:

**Client ID:** **WEEK OF:** __/__/__

**DAILY SEDIMENT MONITORING - CHECKLIST:** **ACTIVITY / DAY**

| AM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | 23.3<br>22.7<br>22.4 | 23.2<br>22.7<br>22.5 | | | | | |
| Fill Reservoirs | ✓ | | | | | | |
| Delivery tubes in place | ✓ | / | | | | | |
| Check water Supply | ✓ | / | | | | | |
| Empty Waste Buckets | ✓ | / | | | | | |
| Floater/Aeration* Check | ✓ | / | | | | | |
| Chems Collected / ok? | ✓ | | | | | | |

| NOON | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Splitter box(s) filling? | ✓ | | | | | | |
| Syringes filing? | ✓ | / | | | | | |
| Needles flowing? | ✓ | / | | | | | |
| Drainage to Waste? | ✓ | / | | | | | |
| Feeding (Time/Init.) | 05:12 | | | | | | |

| PM | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| Temperature(s): | 23.1<br>22.9<br>22.8 | | | | | | |
| Fill Reservoirs | ✓ | / | | | | | |
| Delivery tubes in place | ✓ | / | | | | | |
| Check water Supply | ✓ | / | | | | | |
| Empty Waste Buckets | ✓ | / | | | | | |
| Floater/Aeration* Check | ✓ | | | | | | |
| Date: | 8/6/17 | 8/7/17 | | | | | |
| Initials: | TV | TV | | | | | |

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| **Corrective Actions / Comments (Initial/Time)**<br>* Aeration required if DO is below/reaching minimum DO | Sample 50430 - has gases forming in sediment. Checked D.O. Rep A - 4.0 Rep E - 3.5<br>Tapped beakers to resettle seds. TV | TEST END 1630 | | | | | |

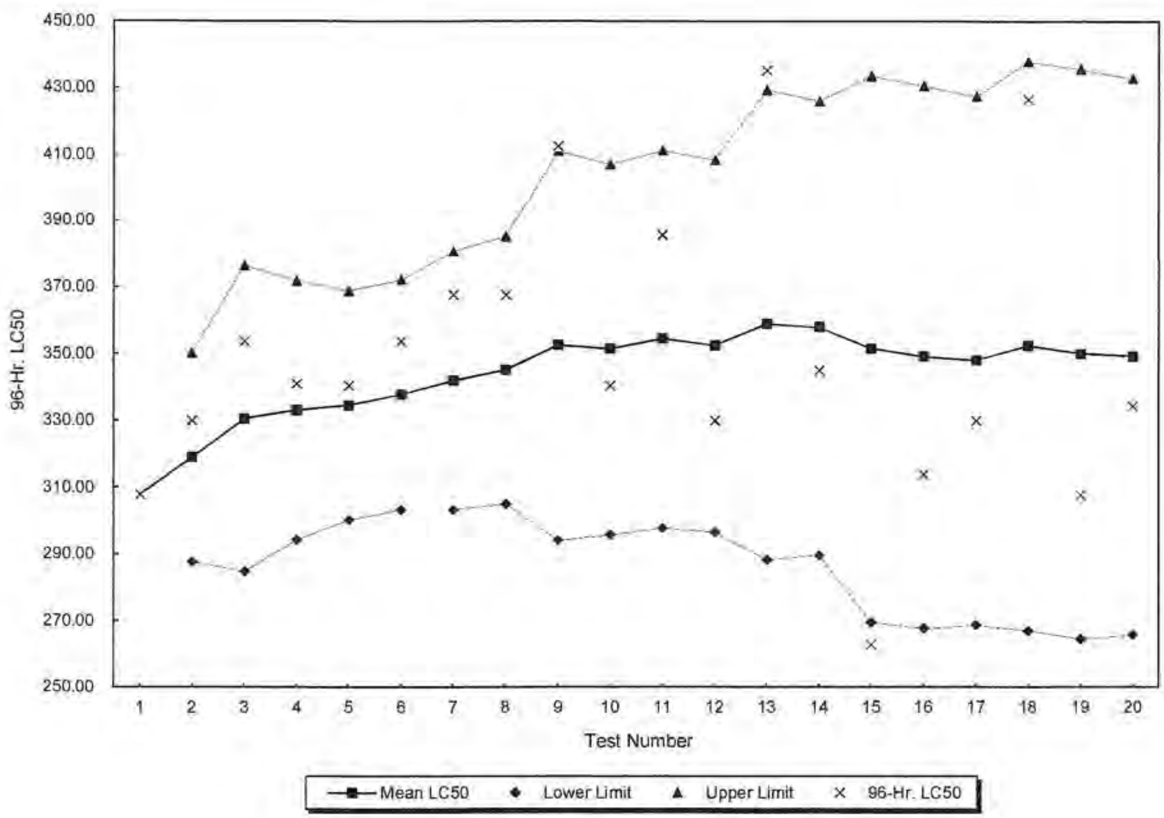
**Aquatec Environmental, Inc.**
Reviewed by: TV Date: 9/9/17

**SDG:**
**Project**

# Standard Reference Toxicant Control Chart(s)

# Reference Toxicant Control Chart
## *Hyalella azteca*
## in Potassium chloride (mg/L)

| Test Number | Test Date | Organism Age (Days) | 96-Hr. LC50 | Mean LC50 | Lower Limit | Upper Limit | Organism Source |
|---|---|---|---|---|---|---|---|
| 1 | 07/31/13 | 8 | 307.800 | 307.80 | | | Aquatic Research Organisms |
| 2 | 08/08/13 | 8 | 329.900 | 318.85 | 287.60 | 350.10 | Aquatic Research Organisms |
| 3 | 09/17/13 | 7 | 353.600 | 330.43 | 284.62 | 376.24 | Aquatic Research Organisms |
| 4 | 11/05/13 | 11 | 340.800 | 333.03 | 294.21 | 371.84 | Aquatic Research Organisms |
| 5 | 06/27/14 | 12 | 340.300 | 334.48 | 300.24 | 368.72 | Aquatic Research Organisms |
| 6 | 08/19/14 | 12 | 353.600 | 337.67 | 303.29 | 372.04 | Aquatic Research Organisms |
| 7 | 10/17/14 | 12 | 367.500 | 341.93 | 303.29 | 380.57 | Aquatic Research Organisms |
| 8 | 01/30/15 | 13 | 367.500 | 345.13 | 305.04 | 385.21 | Aquatic Research Organisms |
| 9 | 05/08/15 | 8 | 412.500 | 352.61 | 294.10 | 411.12 | Aquatic Research Organisms |
| 10 | 06/30/15 | 8 | 340.300 | 351.38 | 295.67 | 407.09 | Aquatic Research Organisms |
| 11 | 11/27/15 | 8 | 385.600 | 354.49 | 297.75 | 411.23 | Aquatic Research Organisms |
| 12 | 05/04/16 | 8 | 329.900 | 352.44 | 296.51 | 408.37 | Aquatic Research Organisms |
| 13 | 05/24/16 | 11 | 435.300 | 358.82 | 288.25 | 429.38 | Aquatic Research Organisms |
| 14 | 12/07/16 | 7 | 344.900 | 357.82 | 289.62 | 426.03 | Aquatic Research Organisms |
| 15 | 03/28/17 | 7 | 262.600 | 351.47 | 269.39 | 433.56 | Aquatic Research Organisms |
| 16 | 6/7/17-6/11/17 | 12 | 313.700 | 349.11 | 267.59 | 430.63 | Aquatic Research Organisms |
| 17 | 6/13/17-6/17/17 | 9 | 329.900 | 347.98 | 268.50 | 427.46 | Aquatic Research Organisms |
| 18 | 6/28/17-7/2/17 | 8 | 426.500 | 352.34 | 266.82 | 437.87 | Aquatic Research Organisms |
| 19 | 7/28/17-8/1/17 | 12 | 307.700 | 349.99 | 264.39 | 435.60 | Aquatic Research Organisms |
| 20 | 8/23/17-8/27/17 | 8 | 334.100 | 349.20 | 265.57 | 432.83 | Aquatic Research Organisms |

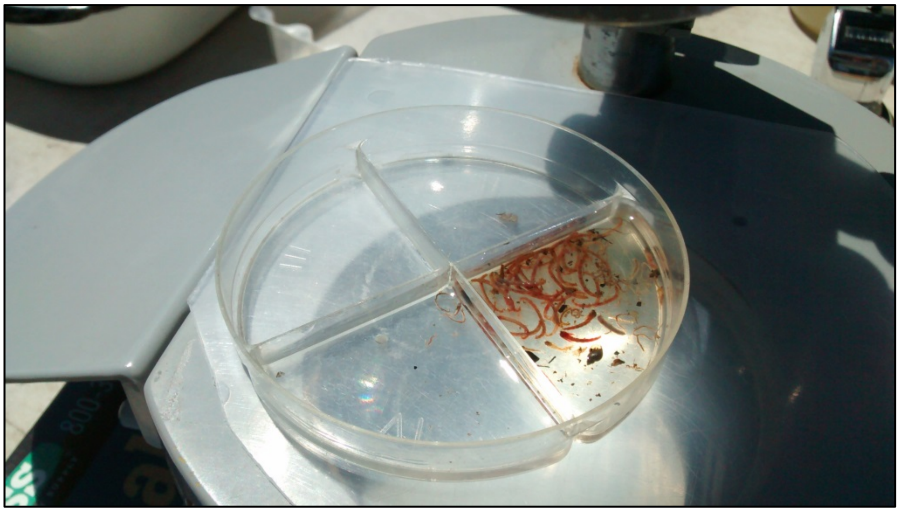



\SRTS\Ha KCL

# Attachment F

# Benthic Macroinvertebrate Community Report for the Anacostia River Pepco Benning Road Facility, October 2017

# Benthic Macroinvertebrate Community Report For The Anacostia River Pepco Benning Road Facility October 2017



**Prepared by:**
**Normandeau Associates, Inc.**
**400 Old Reading Pike**
**Stowe, PA 19464**
**Project Number 24033.000**

**Prepared for:**
**AECOM**
**8000 Virginia Manor Road**
**Suite 110**
**Beltsville, MD 20705**

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# 1.0 INTRODUCTION

Normandeau Associates, Inc. (Normandeau) was contracted by AECOM to complete benthic macroinvertebrate sampling in the Anacostia River, Washington, D.C. This study was a component of the Remedial Investigation and Feasibility Study Work Plan prepared on behalf of Potomac Electric Power Company and Pepco Energy Services, Inc. (Pepco) to describe the technical approach implemented to address remaining data gaps and uncertainties regarding potential contamination at Pepco's Benning Road Facility, located at 3400 Benning Road NE, Washington, D.C., and a segment of the Anacostia River adjacent to the Facility. The benthic macroinvertebrate component focused on the sediments in the segment of the river adjacent to and immediately downstream of the Facility as well as an upstream background segment.

The benthic macroinvertebrate community sampling and subsequent benthic macroinvertebrate community analyses were completed to provide a measurement endpoint for evaluating the *in situ* response of the benthic macroinvertebrate community to potential stressors in the Anacostia River. Normandeau completed the benthic macroinvertebrate community sampling from June 7 through June 13, 2017.

# 2.0 SAMPLE STATIONS

Benthic macroinvertebrate samples were collected from 20 locations following methodology described in a Study Plan approved for the project (AECOM 2016). Fifteen sample locations (near-site) were located in the Anacostia River in the immediate vicinity of the Benning Road Facility and five background sample locations were located between 1 to 2.25 miles upstream from the Benning Road Facility in the Anacostia River (**Figure 1**).

Sample location identifiers for near-site and background benthic macroinvertebrate collections in the Anacostia River:

| Near-site Station | Background Station |
|---|---|
| 6A, 6B, 6C, 6.5D, 6.5E, 7A, 7B, 7D, 7E, 7F, 7.5D, 7.5E, 8A, 8B, 8C | 16, 17, 18, 19, 20 |

# 3.0 METHODS

## 3.1 Sample Collection

Samples were collected using a Petite Ponar Grab (area = 0.023 m2) from the 15 near-site and five background locations according to the Study Plan (AECOM 2016). Maryland Department of Natural Resources sampling protocols (MDNR 2014) were also used as technical guidance. Each sample replicate consisted of a single ponar grab. A total of four replicate Petite Ponar samples were collected from each location for a total of 80 samples. The samples were preserved in the field with isopropanol and transported for analysis to Normandeau Associates' laboratory in Stowe, Pennsylvania on June 16, 2017.

## 3.2 Laboratory Analysis

Three replicates from each location were analyzed and the fourth replicate was archived. In total, 66 data sets were produced for the project: 45 near-site and 15 background sample replicates; plus three field duplicates and three laboratory duplicates. Following receipt at the laboratory, the sample matrices were washed through a 0.500-micron mesh sieve and evenly distributed into a gridded sorting pan for processing. The laboratory analyses were conducted according to two agency protocols) applicable to the project - USEPA (1999) and MDNR (2013. The USEPA protocol calls for random removal of 100 specimens (+/- 20%) to produce a range of 80 to 120 invertebrates for taxonomic analysis. The MDNR protocol calls for random removal of 120 specimens to produce a range between 100 and 120. For this project specimens were removed from randomly selected grids until a preliminary count of 120 specimens was obtained. A final count between 80 and 120 (once worm fragments were subtracted) was targeted. Any replicates containing fewer than 80 specimens were processed in entirety.

For sample matrices containing fewer than 80 specimens, the cumulative totals for all three replicates were combined in order to calculate the probability of occurrence for each taxon. A random computer draw was then applied, using these probabilities, to produce individual 100-counts for each of the replicates.

All specimens were identified to the lowest practicable taxonomic end-point (genus/species), given their age and condition, using dissecting and compound microscopes. Because the Ponar is a quantitative device, estimates of community density (number/$m^2$) were made for each replicate based on the percentage of matrix processed to produce the 100 count subsample.

## 3.3 Chesapeake Bay B-IBI and additional metrics

The Chesapeake Bay B-IBI was used to complete the analysis of the benthic macroinverebrates collected from the Anacostia River. The Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI) is a protocol that was developed to assess benthic community health and environmental quality of the Chesapeake Bay (Versar 2002). The B-IBI evaluates the ecological condition of a sample by comparing values of key benthic community attributes to reference values that would be expected under non-degraded conditions.

Following the procedures described in the B-IBI the benthic macroinvertebrate data were reduced to a set of four ecological metrics. The metrics selected for analysis were developed specifically for tidal freshwater habitats. Two additional metrics not included in the B-IBI, taxa richness and percent contribution of dominant taxa, were also calculated and used in this analysis. The six selected metrics are suitable for describing the benthic macroinvertebrate communities that occur in soft bottom freshwater tidal habitats.

A list of the metrics are provided below.

- Abundance (#/$m^2$)
- Abundance of pollution-indicative taxa (%)
- Abundance of deep-deposit feeders (%)
- Tolerance Score
- Taxa Richness
- Percent Contribution of Dominant Taxa

A summary of each metric, including a notation stating whether the values increase or decrease in response to impairment is provided in **Table 1**.

To facilitate the analyses, each metric was scored. The scoring for the metrics to calculate the B-IBI was completed by comparing the value of a metric from the sample to thresholds established from reference data distributions. A score of 1, 3, or 5 is assigned for each metric. The scoring criteria for each metric is provided in **Table 2**.

The index value for a sample is computed by averaging the scores of the individual metrics. This index value (B-IBI score) is then compared to the B-IBI ranges and benthic community condition used by the Chesapeake Bay Benthic Monitoring Program (**Table 3**). The B-IBI ranges between 1 and 5, with values ≤ 2 being severely degraded and those ≥ 3.0 designated as meeting restoration goals for the Chesapeake Bay.

### 3.4 Statistical Analysis

The structure and composition of the macroinvertebrate community in the Anacostia River was evaluated using several statistical techniques to compare taxa abundance and metric values among the stations.

Spearman's rank correlations were calculated to compare overall numbers of each taxa collected at each station for all replicates combined (n=15 near-site and n=5 background). This coefficient is commonly used for comparing biological assemblages. This analysis involved sorting and ranking species abundance and then calculating the Pearson product-moment correlation. Spearman coefficient values range from -1 to 1, with -1 indicating assemblages that are totally different and 1 indicating assemblages that are identical.

A cluster analysis was completed to evaluate the similarity in taxa counts (all replicates combined) among the stations. The analysis produced a dendrogram that grouped the stations based on similarity of taxa composition and abundance (number of individuals). The dendrogram was constructed using average linkage and Euclidean distance. The purpose of the dendrogram was to provide a visual reference that revealed relationships among the assemblages at the stations.

Two Sample T-tests and one-way ANOVA tests were employed to assess differences in the metric values among stations. The Two Sample T-tests were used to compare mean metric values between the combined background (n= 15 replicates) and combined near-site (n = 45 replicates) stations. The one-way ANOVA tests were used to determine if the metric values were significantly different among the 20 samples stations (n= 3 replicates per station). If the ANOVA tests indicated a significant difference, then pairwise comparisons were completed between each station using the Tukey test. The Tukey test was used to determine if the mean metric values were significantly different between stations. All metric values were tested for normality and homogeneity of variance. Transformations of the data were completed as necessary to improve normality and homogeneity of variance using logarithm base e and arc sin transformations. A p-value < 0.05 was designated to indicate significant differences for all tests.

## 3.5 Quality Assurance and Quality Control

***Quality Assurance***

All sample tracking forms and laboratory bench sheets are on file at Normandeau and available upon request. Sample matrices and identified specimens will be retained at Normandeau for a period of three years. Specimen identifications were completed by biologists certified for taxonomic analysis by the Society for Freshwater Science.

***Quality Control***

To adhere to MDNR protocol, the fourth matrix (effectively an additional replicate) collected from three of the sample stations was analyzed. To illustrate the comparisons, community density from the fourth replicate was compared to the range of values obtained from the first three replicates collected at each station.

Density (number/m$^2$) comparison for sample stations with the fourth replicate processed.

| Sample Station | Range of Replicates 1-3 | Replicate 4 |
|---|---|---|
| 6.5D | 32,919 – 62,733 | 20,348 |
| 8B | 2,391 – 5,275 | 3,478 |
| 19 | 1,043 - 8,792 | 5,043 |

The number of specimens collected from the fourth replicate fell within the range of the first three replicates for Stations 8B and 19; the fourth replicate for Station 6.5D was lower than the other three replicates.

Laboratory duplicates were analyzed for three of the replicates. The duplicate replicates were selected at random and an additional 100 organism subsample was removed from each sample. The organisms from the laboratory duplicates were processed and identified in an identical manner to the other replicates. Morisita's Index of Community Similarity was used to compare taxonomic composition between sample pairs. The index uses the presence/absence and the percent composition of all taxa present to illustrate the precision between the two analyses.

Values range between 0.00 and 1.00, where high numbers indicate a high degree of similarity between original and duplicate samples.

Morisita's Index of Community Similarity comparison for laboratory duplicates

| Replicate | Morisita's Similarity Index |
|---|---|
| 6.5D - Rep. 1 | 0.75 |
| 6.5D – Rep 4 | 0.93 |
| 7F – Rep. 4 | 0.65 |

These results show the taxonomic composition of the paired samples to be generally similar.

The efficiency of specimen removal was verified via independent re-processing of three of the sample replicate by a second technician. Quality Control results were considered acceptable if 90.0 percent or more of both taxa and specimens were removed during the initial effort. The results from re-processing the selected matrices are given here:

| Replicate | Taxa (%) | Specimens (%) |
|---|---|---|
| 8A – Rep. 1 | 100.0 | 90.3 |
| 17 – Rep. 4 | 100.0 | 93.0 |
| 19 – Rep. 4 | 100.0 | 97.4 |

Identification and enumeration (the gross count) of the sorted specimens was verified through independent re-analyses of three of the sample replicates by a second biologist. The data were considered acceptable if 90.0 percent or more of the taxa and counts were confirmed. The results are provided below:

| Replicate | Taxa (%) | Gross Count (%) |
|---|---|---|
| 6B – Rep. 4 | 100.0 | 93.1 |
| 7A – Rep 4 | 100.0 | 98.5 |
| 8B – Rep 3 | 100.0 | 94.5 |

# 4.0 RESULTS

Benthic macroinvertebrate collections made at 20 stations in 2017 yielded a total of 6,127 organisms that were processed and identified (**Table 4**). A total of 35 taxa were collected among all stations. The data indicated taxonomically poor benthic macroinvertebrate communities at all (both near-site and background) stations. The number of taxa identified from individual replicates ranged from 3 at Station 19 to 14 at Stations 6A and 7A. The identities of the most abundant macroinvertebrate taxa were similar among collection stations (**Table 5**). The samples contained taxa expected to be found in soft bottom freshwater tidal habitats, including aquatic worms (Oligochaeta), midges (Chironomidae), Asiatic clams (*Corbicula fluminea*), round worms (Nematoda), pill clams (*Pisidium*), leeches (Glossophoniidae) and crustaceans (*Caecidotea* and *Gammarus*).

A few benthic macroinvertebrate taxa composed a large proportion of all organisms collected at each of the stations. With few exceptions, *Limnodrilus* species, *Corbicula fluminea*, Nematoda, *Tanypus neopunctipennis*, and *Chironomus decorus* group were among the most abundant organisms collected at all stations (**Table 6**). The percent contribution of the most abundant taxon ranged between 63.7% (*Limnodrilus* spp.) at Station 19 to 23.9% (*Chironomus decorus* gr.) at Station 7E. For most stations, three taxa composed a large proportion of all organisms that were collected. Percent composition of the three most abundant taxa ranged between 96.1% (*Limnodrilus* spp.) at Station 17 to 59.4% (*Chironomus decorus* group, Nematoda, and *Limnodrilus hoffmeisteri*) at Station 7E. Other taxa common to most stations included *Ilyodrilus templetoni*, *Pisidium*, and *Branchiura sowerbyi*. The remaining taxa were present in low numbers and were collected at only a few of the stations.

Spearman's Rank Correlation Coefficients indicated that species composition was generally similar between near-site stations, between background stations, and between near-site and background stations. Comparisons between most of the stations yielded correlation coefficients greater than 0.50 with no negative coefficients (**Table 7**). Correlations between the background stations were high with all coefficients greater than 0.80. Correlations between the near-site stations were much more variable with a wide range of coefficients with the highest correlation between 6A and 8A (0.982) and the lower correlation between 7A and 7D and 7D and 6A (0.037). Stations 7D and 6.5D showed the greatest difference with many of the stations, both near-site and background. With the exception of Stations 7D and 6.5D the correlations between background and near-site stations were generally high.

The dendrogram produced from the analysis separated the benthic macroinvertebrate stations into three groups based on similarity (**Figure 2**). All five background stations were grouped together along with near-site stations 6C and 8C. The other two groupings contained the remaining near-site stations. The grouping of the stations corresponded well with the results of the Spearman's Rank correlation matrix. Station pairs with the highest correlations coefficient were grouped together and were most closely linked

The mean number of taxa from the near-site stations was 8.44 compared to 7.07 for the background stations and the difference was not statistically significant (**Table 8)**. Abundance averaged 12,905.70 individuals per square meter from the near-site stations compared to 3,344.60 per square meter at the background stations and the mean densities were significantly different. Mean tolerance scores were similar between background (9.6) and near-site (9.32) stations and were not significantly different. Mean percent of pollution indicative taxa were significantly higher at the background (88.70%) compared to near-site (57.04%) stations. Mean percent of deep-deposit feeder taxa were significantly higher for the background (92.67%) compared to near-site (62.50%) stations.

Mean metric values computed by station for total taxa, density, tolerance score, pollution indicative taxa (%), and deep-deposit feeders (%) are provided in **Table 9**. Mean total taxa ranged from 4.7 at Station 7F to 11.3 at 8B and 7A. Total taxa were significantly different (**Table 10**) between background stations, between near-site stations and between background and near-site stations. In general, total taxa values were higher for the near-site as compared to the background stations (**Figure 3**).

Mean density ranged from 1,217.4 individuals/m$^2$ at Station 6C to 44,862.0 individuals/m$^2$ at 6.5D (Table 9). Densities were significantly different (**Table 10**) between background and near-site stations and between near-site stations. The highest density values were observed at near-site stations 6.5D, 6.5E, 7D, and 7F with considerable variability among the three sample replicates at these stations (**Figure 4**).

Mean tolerance scores ranged between 7.8 at 7A to 9.8 at 7E, 7F, and 17 (Table 9). Tolerance scores were significantly different (**Table 10**) between background stations, between near-site stations and between background and near-site stations. Tolerance scores were generally greater than 8.5 with the exception of Station 7A (**Figure 5**).

Mean abundance of pollution-indicative taxa (%) ranged between 17.8 at 7D to 96.1 at 17 (Table 9). Abundances of pollution-indicative taxa (%) were significantly different (**Table 10**) between background stations, between near-site stations and between background and near-site stations. Abundances of pollution-indicative taxa (%) were generally higher with less variation at the background stations as compared to near-site stations (**Figure 6**).

Mean abundance of deep-deposit feeders (%) ranged between 21.4 at 7D to 98.0 at 8C (Table 9). Abundances of deep-deposit feeders (%) were significantly different (**Table 10**) between background stations, between near-site stations and between background and near-site stations. Abundances of deep-deposit feeders (%) were generally higher with less variation at the background stations as compared to near-site stations (**Figure 7**).

The B-IBI scores were generally higher for the combined near-site stations as compared to the combined background stations (**Figure 8**). The B-IBI scores ranged between 1 at Stations 17, 18, 19 and 4 at Station 7A (**Table 11**). Mean B-IBI scores were low for Stations 8C, 20, 17, and 18. The highest mean scores were for 8B, 7D, 7.5D, 7.5E, and 6.5D. B-IBI scores for individual stations were variable with considerable overlap between near-site and background stations (**Figure 9**). Most of mean B-IBI scores fell between 2.1 and 2.9, the range designated as degraded or marginal according to the Chesapeake B-IBI protocol (**Table 3**). Six of the near-site stations (6.5D, 7.5D, 7.5E, 7A, 7D, and 8B) had an B-IBI score > 3.0 which is designated as meeting the restoration goals of the Chesapeake Bay Benthic Monitoring Program, whereas three of the background stations (17, 18, and 20) had an B-IBI score < 2.0, which indicates severe degradation.

# 5.0 CONCLUSIONS

The benthic macroinvertebrate community in the Anacostia River was composed of taxa that are well adapted to soft bottom substrates in anthropogenically affected water bodies. These include oligochaete worms, chironomid midges, and Asiatic clams. The taxa that were collected during this investigation are ubiquitous in these types of habitats throughout the northeastern United States. These organisms are generally tolerant of many forms of pollution and are the common types of organisms that persist in degraded environments.

Benthic macroinvertebrate taxonomic composition was generally similar between the near-site and background stations, with some overlap in the metrics between the background and near-site stations. However, in general, the background stations had lower abundance, higher tolerance scores, lower total taxa, higher percent contribution of pollution indicative taxa, and higher percent contribution of deep-deposit feeders as compared to the near-site stations. These data indicate greater impairment at the background stations than at the near-site stations.

# 6.0 REFERENCES

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MDNR. 2011. Maryland Biological Stream Survey Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy. MDNR, Annapolis, MD.

United States Environmental Protection Agency (USEPA). 1999. Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, Second Edition. USEPA (EPA 841-B-99-002), Washington, DC.

Versar, Inc. 2002. Methods for calculating the Chesapeake Bay benthic index of biotic integrity. November 2002.

# FIGURES


N

LEGEND

Macroinvertebrate Sample Location

Benning Road Facility Property Boundary

0 0.1 0.2 0.4 Miles

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**Figure 1.**
**Benthic macroinvertebrate sample stations for the Pepco Benning Road Site, June 7 to June 13, 2017.**

| Date: 9/26/2017 | Revised: | 400 Old Reading Pike Bldg A Suite 101 Stowe, PA 19464 |
|---|---|---|
| | | PREPARED FOR: BWL PROJECT: 24033.000 PREPARED BY: SAS |

Path: C:\Projects\AECOM_PEPCO_BenningRd_24033\MXD\Fig1_MacroLocations_092617.mxd

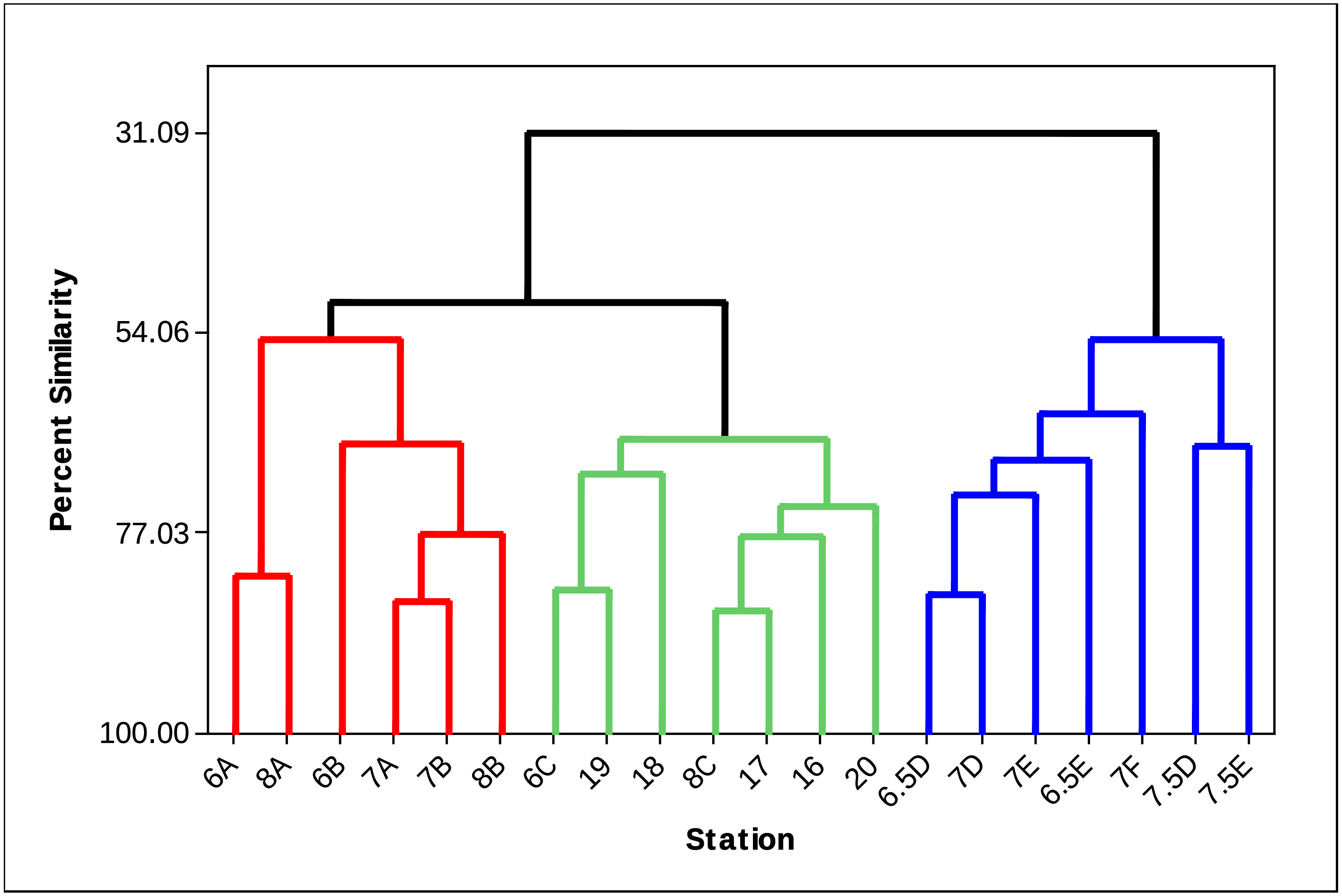


Figure 2. Dendrogram of benthic macroinvertebrate assemblages at 20 stations on the Anacostia River, clustered using average linkage.

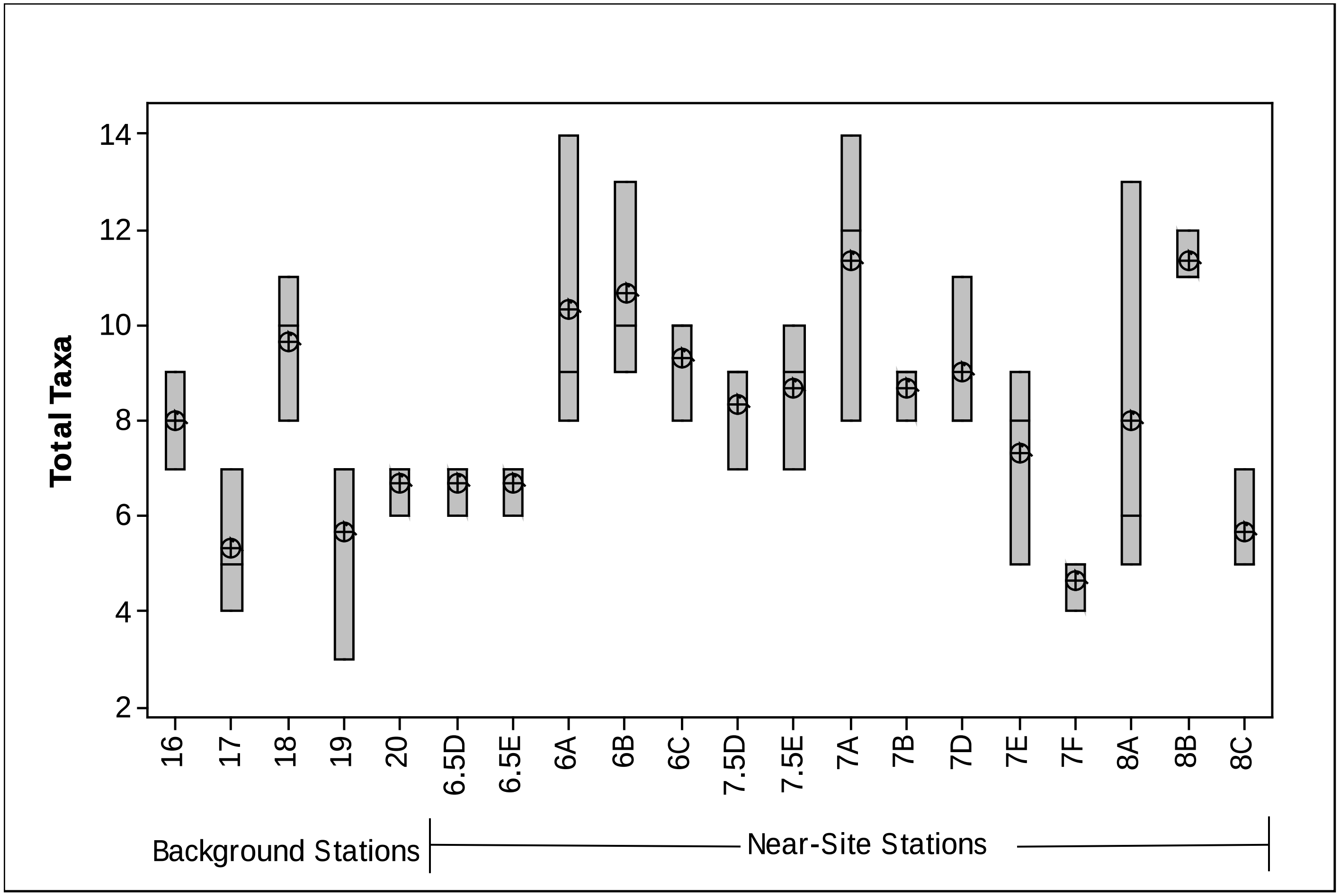


Figure 3. Box plot illustrating Total Taxa for Background and Near-Site Stations collected from Anacostia River, June 2017. (boxes = interquartile range containing 50% of the values, the line across the box = median value, open circle with cross = mean).

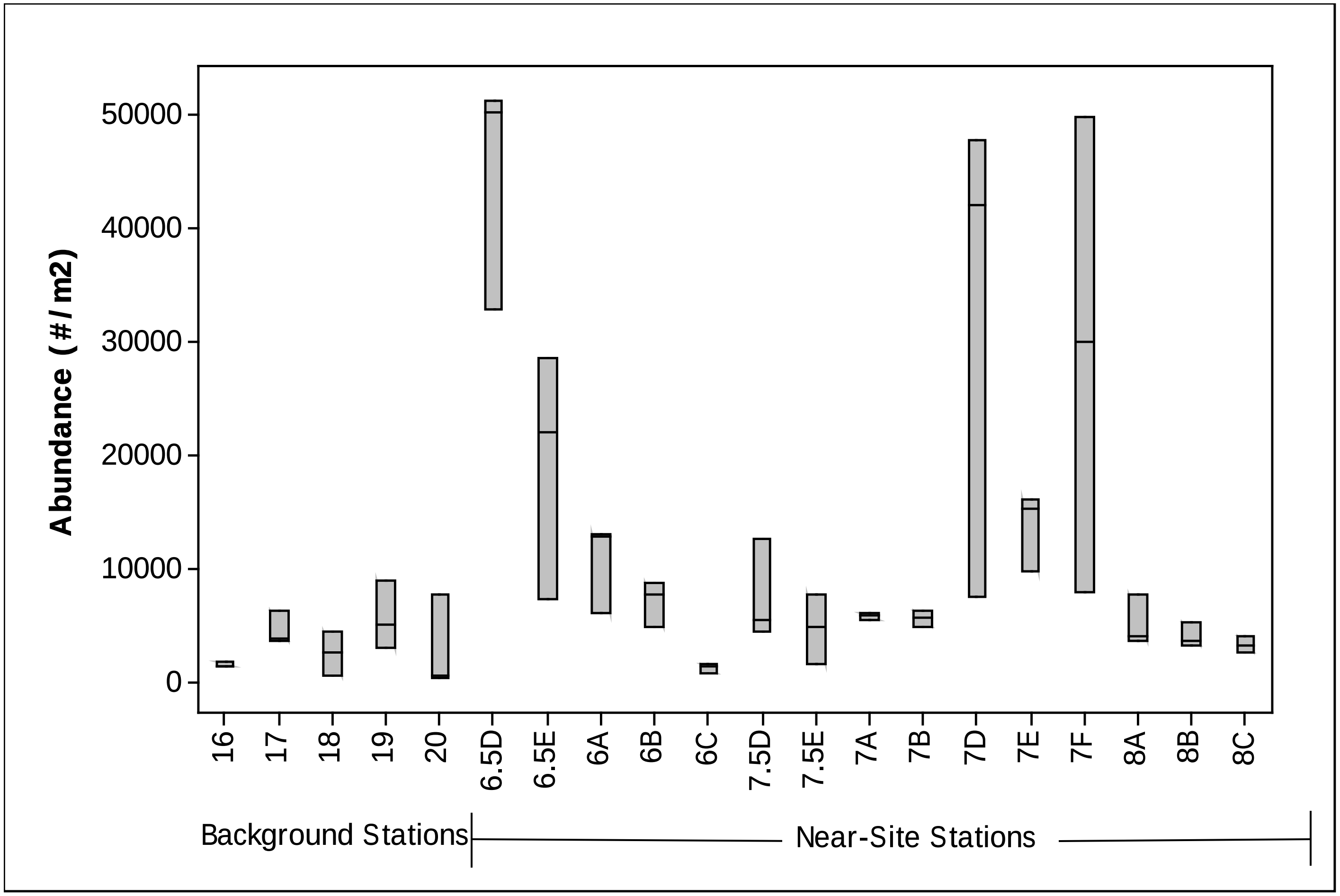


Figure 4. Box plot illustrating Abundance (#/m2) for Background and Near-Site Stations collected from Anacostia River, June 2017. (boxes = interquartile range containing 50% of the values, the line across the box = median value, open circle with cross = mean).

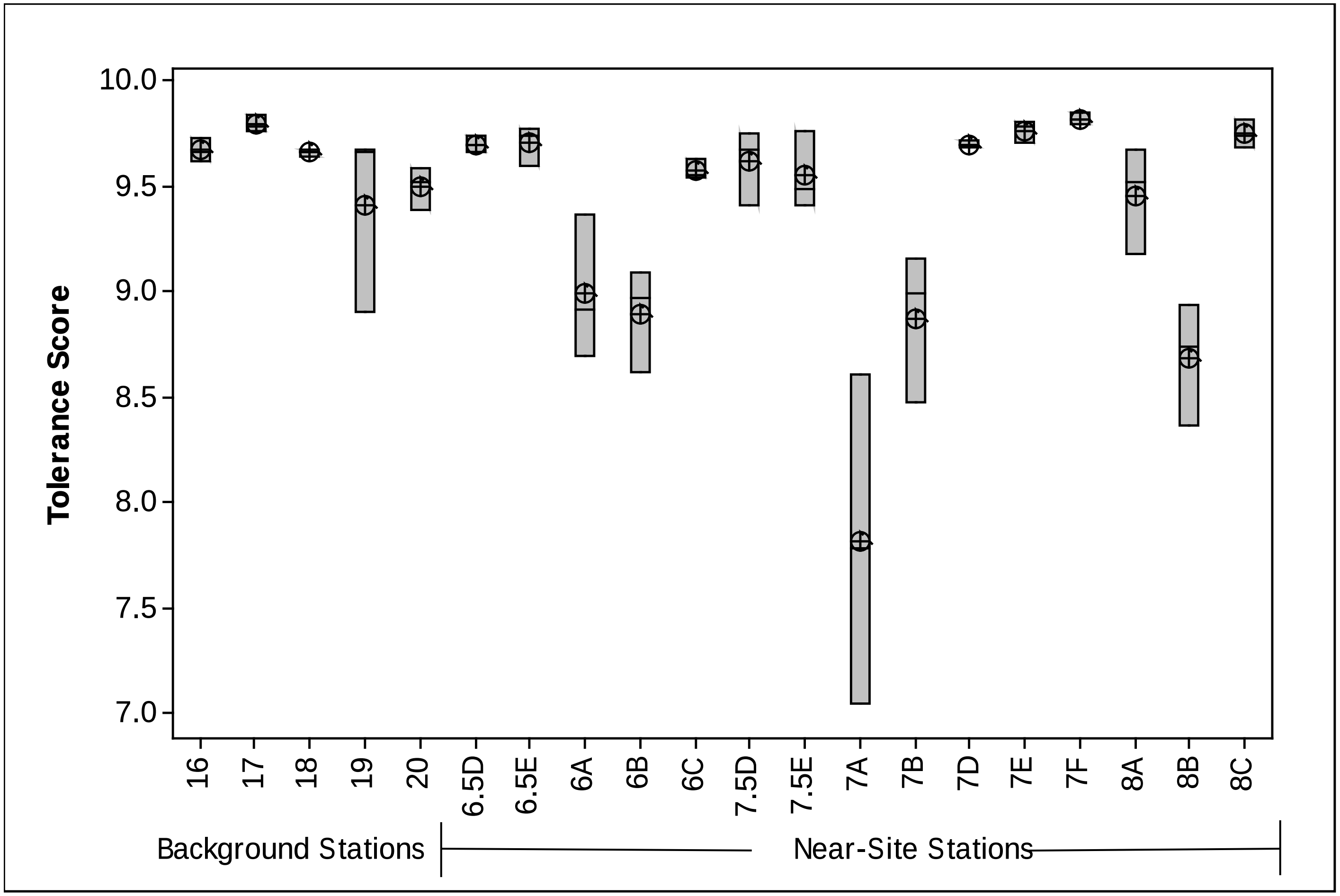


Figure 5. Box plot illustrating Tolerance Score for Background and Near-Site Stations collected from Anacostia River, June 2017. (boxes = interquartile range containing 50% of the values, the line across the box = median value, open circle with cross = mean).

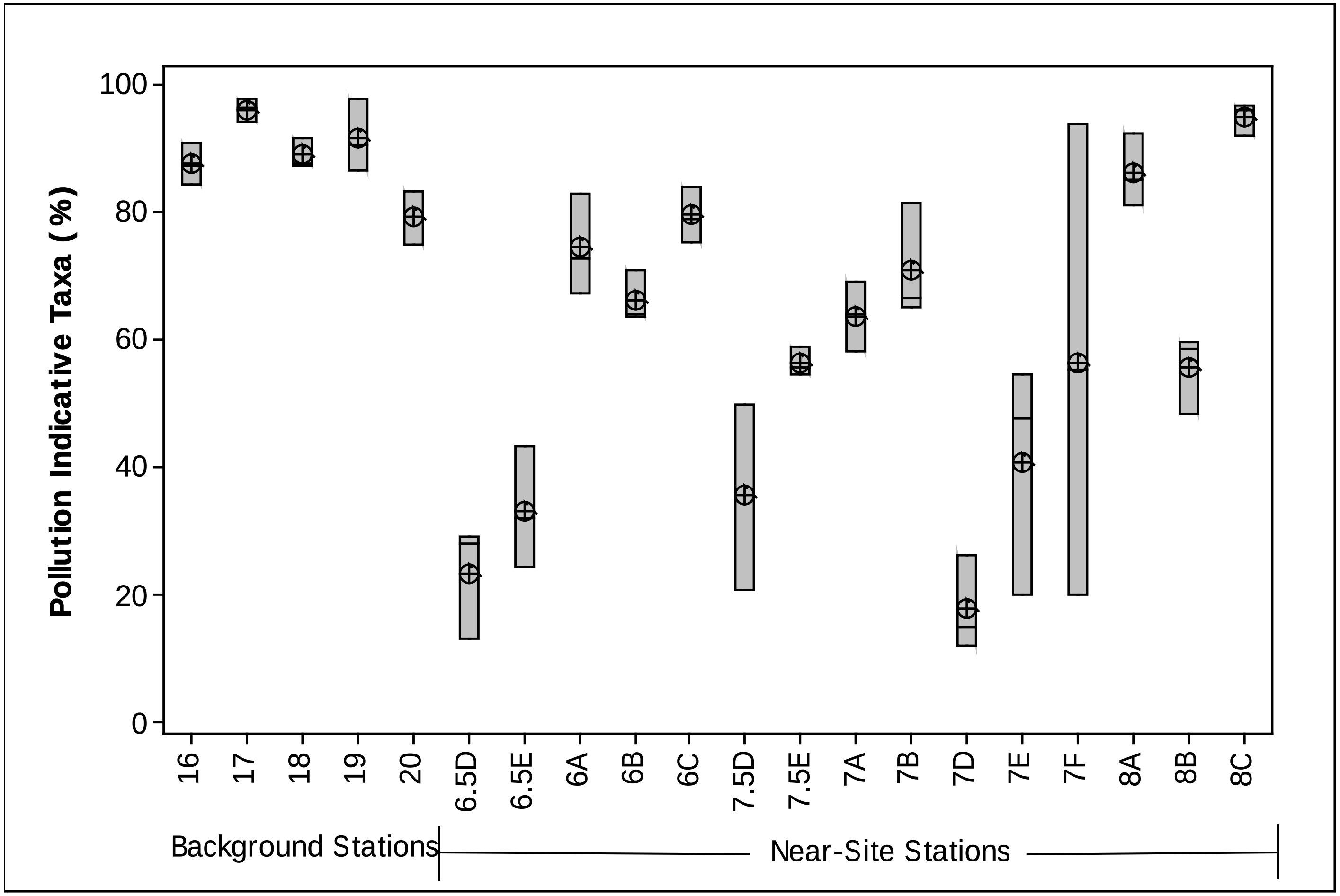


Figure 6. Box plot illustrating the Percent Composition of Pollution Indicative Taxa for Background and Near-Site Stations collected from Anacostia River, June 2017. (boxes = interquartile range containing 50% of the values, the line across the box = median value, open circle with cross = mean).

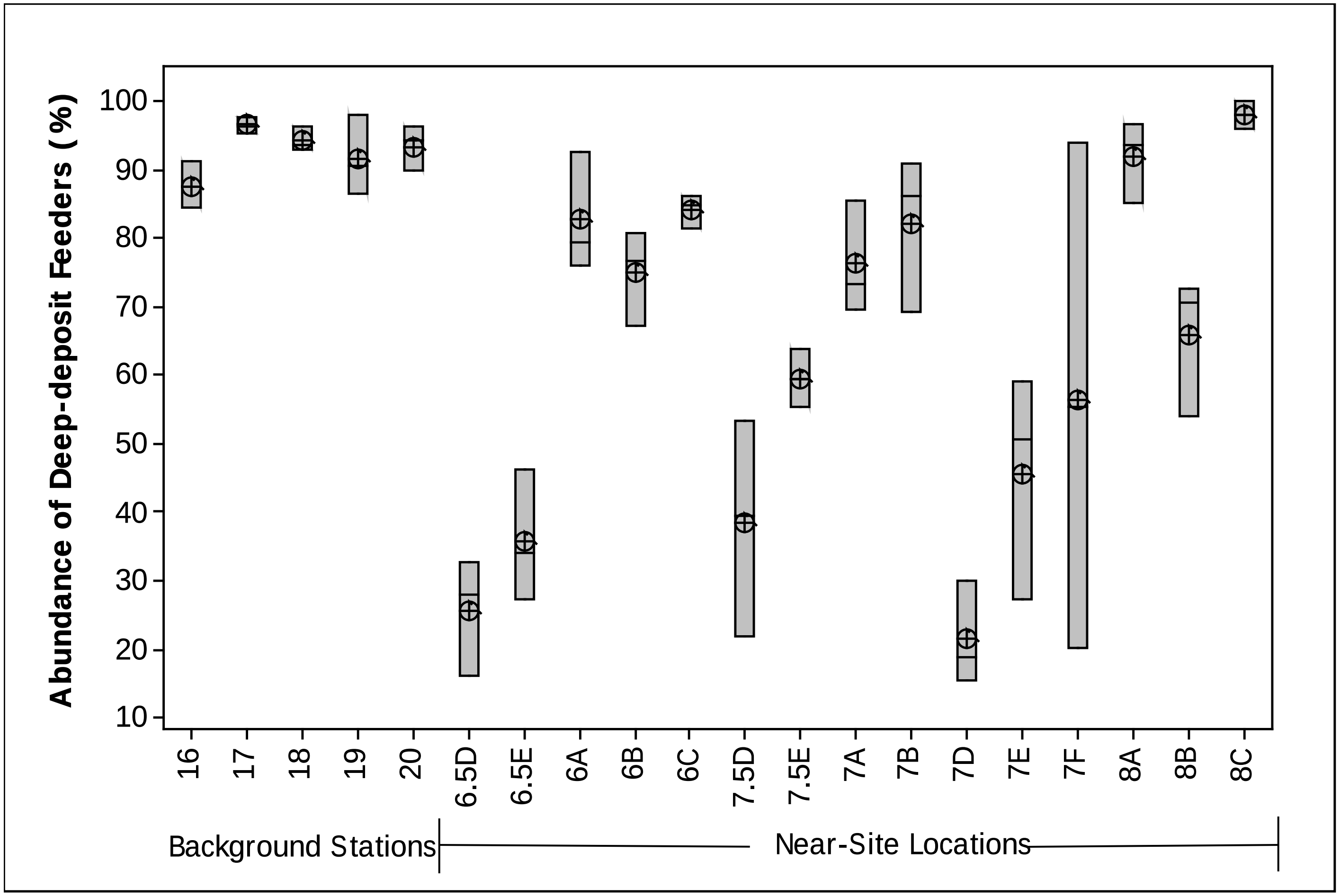


Figure 7. Box plot illustrating Percent Composition of Deep-deposit Feeders for Background and Near-Site Stations collected from Anacostia River, June 2017. (boxes = interquartile range containing 50% of the values, the line across the box = median value, open circle with cross = mean).

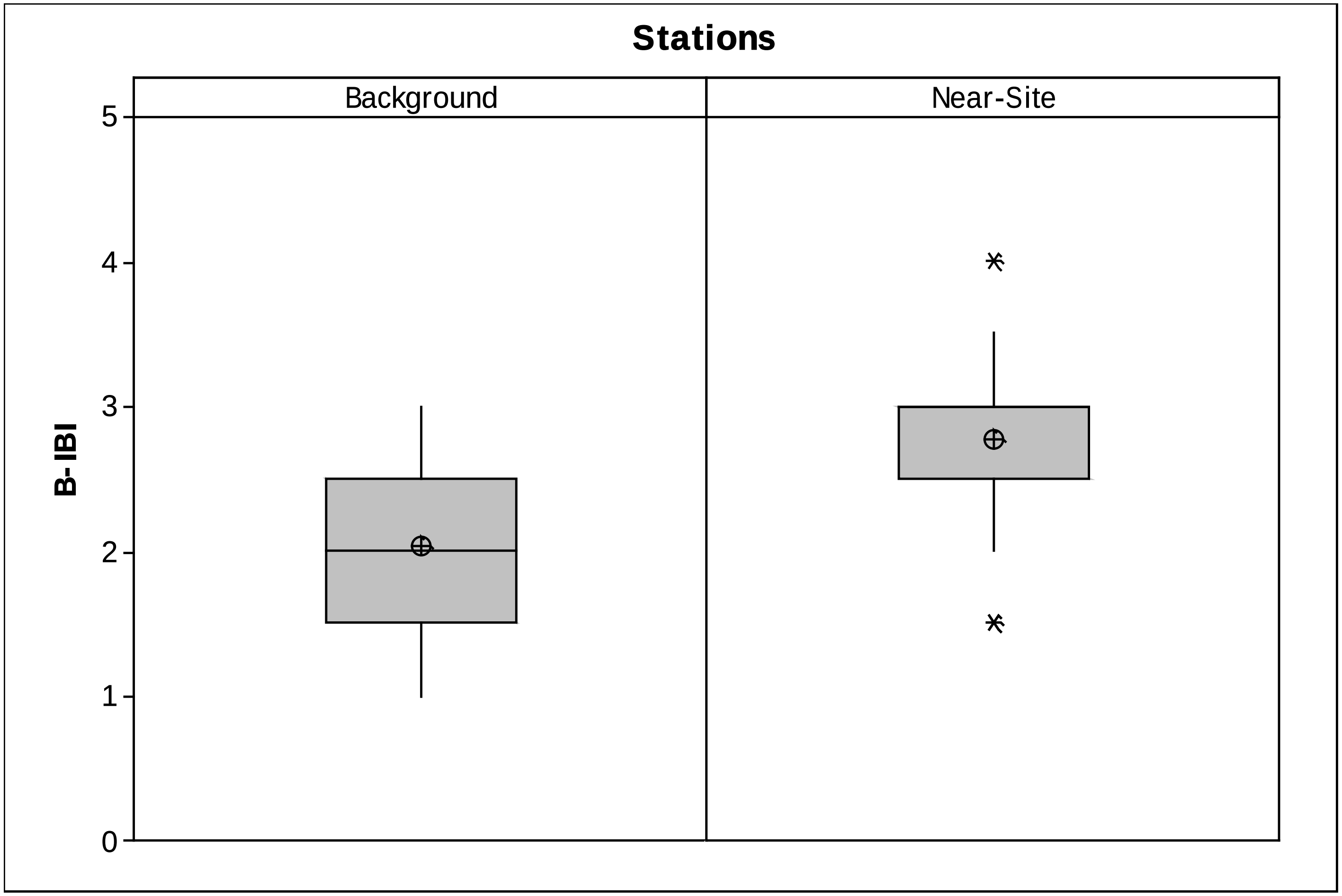


Figure 8. Box plot illustrating B-IBI scores for combined Background and combined Near-Site Stations collected from Anacostia River, June 2017. (boxes = interquartile range containing 50% of the values, the line across the box = median value, vertical lines extending from the box = highest and lowest values, and asterisk = outlier, open circle with cross = mean).

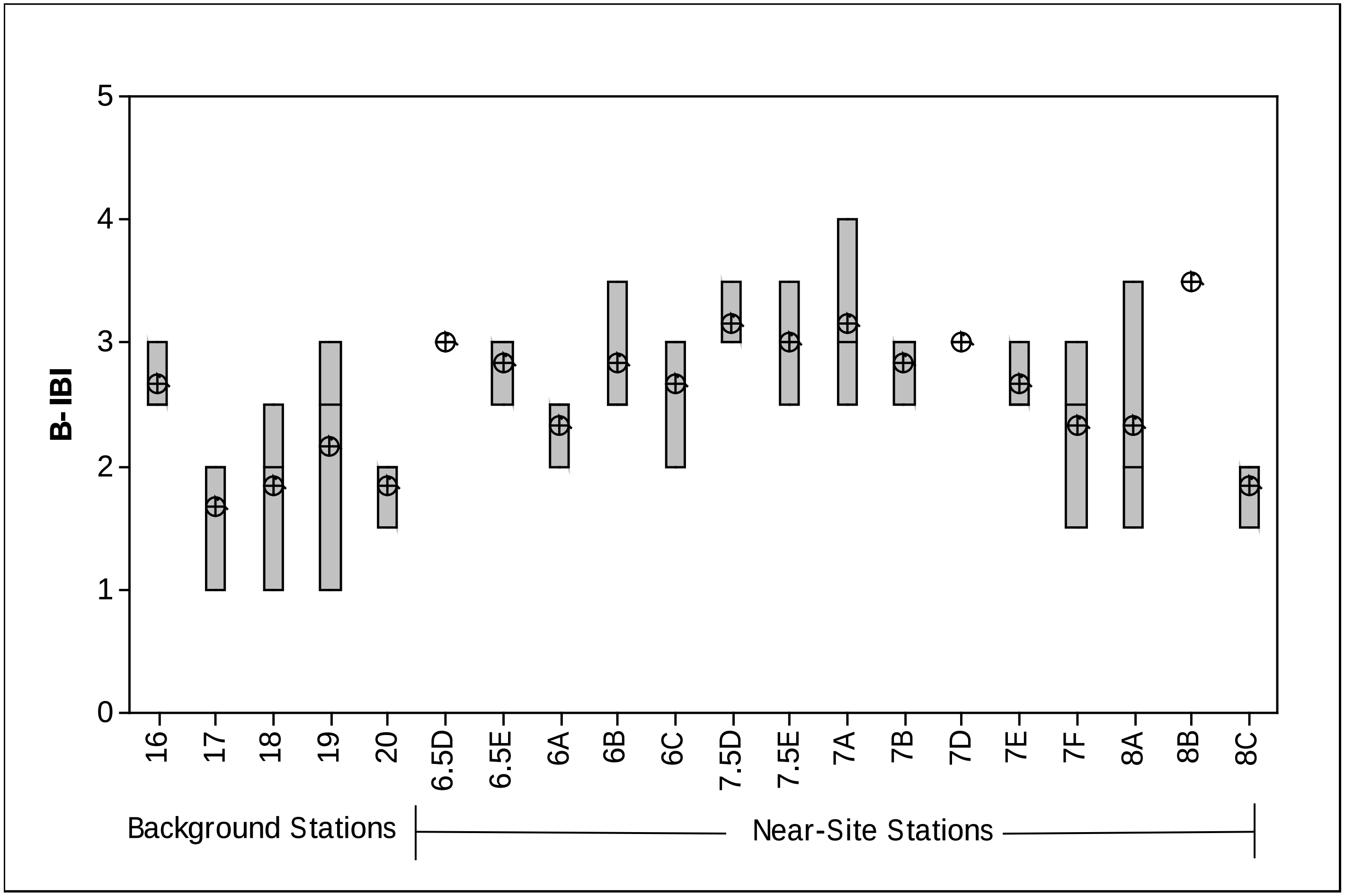


Figure 9. Box plot illustrating B-IBI values for benthic macroinvertebrate stations collected from Anacostia River, June 2017. (boxes = interquartile range containing 50% of the values, the line across the box = median value, open circle with cross = mean).

# TABLES

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**Table 1. Description and response to impairment of the tidal freshwater metrics used in the Chesapeake B-IBI and additional metrics used to describe the benthic macroinvertebrate community.**

| Metric | Description | Response to Impairment |
|---|---|---|
| Abundance (#/$m^2$) | This is the total number of organisms in a sample per square meter (density). Response to impairment is variable. Extremely high or low abundance generally reflects impairment. | variable |
| Abundance of pollution-indicative taxa (%) | This is the percent abundance contribution of taxa classified as pollution-indicative to the total abundance of organisms in a sample. Pollution-indicative taxa are species that are tolerant of pollution and generally display opportunistic life-history characteristics. | increases |
| Abundance of deep-deposit feeders (%) | This is the percent abundance of taxa that feed below the sediment-water interface to the total abundance of organisms in a sample. | increases |
| Tolerance Score | This is a weighted abundance average for taxa classified according to their sensitiveness to pollution. The higher the tolerance (scale of 1-10) the more resistant the species is to stress. The tolerance score is calculated in an identical fashion to the Hilsenhoff Biotic Index and tolerance values are those of Lenat (1993). | increases |
| Taxa Richness | This is the total number of taxa in a sample. | decreases |
| Percent Contribution Dominant Taxa | This is the percent contribution of the taxa with the greatest number of individuals in a sample. | increases |

**Table 2. Threshholds used to score the tidal freshwater metrics for the Chesapeake B-IBI.**

| Metric | Scoring Criteria 5 | 3 | 1 |
|---|---|---|---|
| Abundance (#/$m^2$) | ≥1050-4000 | 800-1050 or ≥4000-5500 | <800 or ≥5500 |
| Abundance of pollution-indicative taxa (%) | ≤39 | 39-87 | >87 |
| Abundance of deep-deposit feeders (%) | ≤70 | 70-95 | >95 |
| Tolerance Score | ≤8 | 8-9.35 | >9.35 |

**Table 3. B-IBI ranges and benthic community condition used by the Chesapeake Bay Benthic Monitoring Program.**

| Benthic Community Condition | B-IBI |
|---|---|
| Meets Restoration goals | ≥3.0 |
| Marginal | 2.7 - 2.9 |
| Degraded | 2.1 - 2.6 |
| Severely Degraded | ≤ 2.0 |

**Table 4. Total number of organisms and metric values by station and replicate for benthic macroinvertebrate taxa collected from the Anacostia River, June 2017.**

| Taxon | Common Name | 6A Rep 1 | 6A Rep 2 | 6A Rep 3 | 6B Rep 1 | 6B Rep 3 | 6B Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | 1 | | | | | |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | 1 | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | 1 | 1 |
| Aulodrilus limnobius | tube worm | | 1 | 1 | 1 | | |
| Branchiura sowerbyi | tube worm | 2 | | 1 | 1 | 1 | |
| Ilyodrilus templetoni | tube worm | 4 | 6 | 6 | 5 | 10 | |
| Limnodrilus sp. | tube worm | 20 | 37 | 22 | 27 | 69 | 38 |
| Limnodrilus claparedeianus | tube worm | | 7 | 15 | 18 | 8 | |
| Limnodrilus hoffmeisteri | tube worm | 68 | 30 | 44 | 18 | | 9 |
| Limnodrilus udekemianus | tube worm | | 4 | | 18 | | 9 |
| Quistadrilus multisetosus | tube worm | 4 | | 2 | 3 | 3 | 2 |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | | 1 | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | 1 | 6 | 1 | 5 | | 1 |
| Batracobdella phalera | leech | | | | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | 6 | 14 | 18 | 15 | 25 | 26 |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | 2 | 3 | 1 | | |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | 2 | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | | | |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | | | 2 | 1 | 1 | 1 |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | 1 | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | 1 |
| Procladius sp. | midge | | | 2 | | 1 | |
| Tanypus neopunctipennis | midge | | | | | | |
| Total Specimens | | 106 | 107 | 120 | 114 | 120 | 88 |
| **Metric** | | | | | | | |
| Total Taxa | | 8 | 9 | 14 | 13 | 10 | 9 |
| Density (number per square meter) | | 12,802 | 12,923 | 6,067 | 7,625 | 8,573 | 4,843 |
| Abundance of Pollution-indicative Taxa (%) | | 83.0 | 72.9 | 67.5 | 71.1 | 64.2 | 63.6 |
| Abundance of deep-deposit feeders | | 92.5 | 79.4 | 75.8 | 80.7 | 76.7 | 67.0 |
| Tolerance Score | | 9.4 | 8.7 | 8.9 | 9.1 | 9.0 | 8.6 |

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**Table 4. (Continued.)**

| Taxon | Common Name | 6C Rep 1 | 6C Rep 2 | 6C Rep 4 | 6.5D Rep 1 | 6.5D Rep 2 | 6.5D Rep 3 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | | | | 35 | 34 | 46 |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | 2 | 2 | 2 | | | |
| Ilyodrilus templetoni | tube worm | 1 | | 1 | | 4 | 3 |
| Limnodrilus sp. | tube worm | 50 | 66 | 62 | 22 | 12 | 13 |
| Limnodrilus claparedeianus | tube worm | 10 | 8 | 4 | | | 1 |
| Limnodrilus hoffmeisteri | tube worm | 17 | 10 | 17 | 11 | 23 | |
| Limnodrilus udekemianus | tube worm | | | | | | |
| Quistadrilus multisetosus | tube worm | 3 | | 3 | | | |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | | | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | 4 | | | |
| Batracobdella phalera | leech | 2 | 2 | | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | 4 | 2 | 2 | | | |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | | | 3 | 1 | 3 |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | | | |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | 5 | 4 | 4 | 32 | 36 | 35 |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | | | | | | |
| Tanypus neopunctipennis | midge | 8 | 6 | 6 | 15 | 10 | 5 |
| Total Specimens | | 102 | 100 | 105 | 118 | 120 | 106 |

| Metric | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Taxa | | 10 | 8 | 10 | 6 | 7 | 7 |
| Density (number per square meter) | | 739 | 1,391 | 1,522 | 51,304 | 50,362 | 32,919 |
| Abundance of Pollution-indicative Taxa (%) | | 75.5 | 84.0 | 79.0 | 28.0 | 29.2 | 13.2 |
| Abundance of deep-deposit feeders | | 81.4 | 86.0 | 84.8 | 28.0 | 32.5 | 16.0 |
| Tolerance Score | | 9.5 | 9.6 | 9.5 | 9.7 | 9.7 | 9.7 |

**Table 4. (Continued.)**

| Taxon | Common Name | 6.5E Rep 2 | 6.5E Rep 3 | 6.5E Rep 4 | 7A Rep 1 | 7A Rep 2 | 7A Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | 36 | 16 | 22 | 1 | | |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | 1 |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | 9 | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | 1 | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | 1 | | | 2 | 2 | 2 |
| Ilyodrilus templetoni | tube worm | 2 | 3 | 1 | 3 | | 12 |
| Limnodrilus sp. | tube worm | 29 | 37 | 30 | 29 | 33 | 19 |
| Limnodrilus claparedeianus | tube worm | | 9 | | 19 | | 13 |
| Limnodrilus hoffmeisteri | tube worm | | | | 19 | 26 | 32 |
| Limnodrilus udekemianus | tube worm | | | | | | 6 |
| Quistadrilus multisetosus | tube worm | | | | 2 | 3 | 3 |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | | 1 | 1 |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | | | | 4 |
| Batracobdella phalera | leech | | | | 1 | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | | | | 10 | 25 | 20 |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | 2 | | 1 | 1 | 5 |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | | | | 1 |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | 1 | | 1 |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | 35 | 29 | 31 | | | |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | 4 | | | | | |
| Procladius sp. | midge | | | | | 1 | |
| Tanypus neopunctipennis | midge | 11 | 10 | 9 | | | |
| Total Specimens | | 118 | 106 | 94 | 97 | 92 | 120 |
| **Metric** | | | | | | | |
| Total Taxa | | 7 | 7 | 6 | 12 | 8 | 14 |
| Density (number per square meter) | | 28,502 | 21,946 | 7,170 | 5,940 | 5,405 | 5,783 |
| Abundance of Pollution-indicative Taxa (%) | | 24.6 | 43.4 | 31.9 | 69.1 | 64.1 | 58.3 |
| Abundance of deep-deposit feeders | | 27.1 | 46.2 | 34.0 | 85.6 | 69.6 | 73.3 |
| Tolerance Score | | 9.6 | 9.7 | 9.8 | 8.6 | 7.0 | 7.8 |

**Table 4. (Continued.)**

| Taxon | Common Name | 7B Rep 1 | 7B Rep 2 | 7B Rep 3 | 7D Rep 1 | 7D Rep 2 | 7D Rep 3 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | | | | 47 | 24 | 43 |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | | 5 | 2 | 3 | 1 | 1 |
| Ilyodrilus templetoni | tube worm | 18 | 5 | | 1 | 3 | 3 |
| Limnodrilus sp. | tube worm | 43 | 24 | 11 | 10 | 5 | 13 |
| Limnodrilus claparedeianus | tube worm | 11 | 16 | 11 | 3 | 12 | |
| Limnodrilus hoffmeisteri | tube worm | 11 | 24 | 27 | | 6 | 1 |
| Limnodrilus udekemianus | tube worm | | 24 | 5 | 2 | 6 | |
| Quistadrilus multisetosus | tube worm | 3 | | | | | |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | | | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | | | | |
| Batracobdella phalera | leech | | | | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | 11 | 8 | 20 | | | |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | 2 | | 2 | | | 1 |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | 1 | | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | | | |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | 1 | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | 1 | 1 | 2 | 23 | 47 | 45 |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | | | | | 1 | |
| Tanypus neopunctipennis | midge | | | 1 | 12 | 4 | 9 |
| Total Specimens | | 100 | 108 | 81 | 101 | 110 | 116 |

| **Metric** | | | | | | |
|---|---|---|---|---|---|---|
| Total Taxa | 8 | 9 | 9 | 8 | 11 | 8 |
| Density (number per square meter) | 6,124 | 4,696 | 5,503 | 7,443 | 47,826 | 42,029 |
| Abundance of Pollution-indicative Taxa (%) | 65.0 | 81.5 | 66.7 | 14.9 | 26.4 | 12.1 |
| Abundance of deep-deposit feeders | 86.0 | 90.7 | 69.1 | 18.8 | 30.0 | 15.5 |
| Tolerance Score | 9.2 | 9.0 | 8.5 | 9.7 | 9.7 | 9.7 |

Table 4. (Continued.)

| Taxon | Common Name | 7E Rep 1 | 7E Rep 3 | 7E Rep 4 | 7F Rep 2 | 7F Rep 3 | 7F Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | 38 | 5 | 19 | 45 | 1 | 45 |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | | | 1 | | | |
| Ilyodrilus templetoni | tube worm | 7 | 4 | 2 | | | |
| Limnodrilus sp. | tube worm | 19 | 16 | 7 | 22 | 51 | 29 |
| Limnodrilus claparedeianus | tube worm | | 10 | 21 | | 8 | 14 |
| Limnodrilus hoffmeisteri | tube worm | | 21 | 21 | | 33 | 14 |
| Limnodrilus udekemianus | tube worm | | 5 | | | | |
| Quistadrilus multisetosus | tube worm | | | | | | |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | | | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | | | | |
| Batracobdella phalera | leech | | | | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | | | | | | |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | | | | | |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | | | |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | 17 | 28 | 25 | 41 | 5 | 1 |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | | 1 | | | | |
| Tanypus neopunctipennis | midge | 14 | 5 | 7 | 2 | | |
| Total Specimens | | 95 | 95 | 103 | 110 | 98 | 103 |
| **Metric** | | | | | | | |
| Total Taxa | | 5 | 9 | 8 | 4 | 5 | 5 |
| Density (number per square meter) | | 15,298 | 9,606 | 15,994 | 29,891 | 7,890 | 49,758 |
| Abundance of Pollution-indicative Taxa (%) | | 20.0 | 54.7 | 47.6 | 20.0 | 93.9 | 55.3 |
| Abundance of deep-deposit feeders | | 27.4 | 58.9 | 50.5 | 20.0 | 93.9 | 55.3 |
| Tolerance Score | | 9.7 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 |

Table 4. (Continued.)

| Taxon | Common Name | 7.5D Rep 2 | 7.5D Rep 3 | 7.5D Rep 4 | 7.5E Rep 1 | 7.5E Rep 2 | 7.5E Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | 13 | | | 1 | 4 | 4 |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | 1 | 1 | | 1 | 1 | |
| Ilyodrilus templetoni | tube worm | 3 | | 3 | 3 | 4 | 1 |
| Limnodrilus sp. | tube worm | 31 | 10 | 13 | 31 | 56 | 15 |
| Limnodrilus claparedeianus | tube worm | 1 | | 7 | 13 | | 23 |
| Limnodrilus hoffmeisteri | tube worm | 4 | 7 | 26 | 15 | 9 | 23 |
| Limnodrilus udekemianus | tube worm | | 4 | | | | |
| Quistadrilus multisetosus | tube worm | | | | | | |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | | | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | | | | |
| Batracobdella phalera | leech | | | | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | | 1 | | | | |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | 1 | | | 1 | | 3 |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | | | 1 |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | 1 |
| Bezzia/Palpomyia | sand fly | | 4 | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | 15 | 37 | 23 | 31 | 24 | 32 |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | | 1 | 2 | | | |
| Tanypus neopunctipennis | midge | 32 | 35 | 18 | 10 | 12 | 9 |
| Total Specimens | | 101 | 100 | 92 | 106 | 110 | 112 |
| **Metric** | | | | | | | |
| Total Taxa | | 9 | 9 | 7 | 9 | 7 | 10 |
| Density (number per square meter) | | 12,547 | 4,348 | 5,333 | 1,565 | 7,591 | 4,870 |
| Abundance of Pollution-indicative Taxa (%) | | 35.6 | 21.0 | 50.0 | 55.7 | 59.1 | 54.5 |
| Abundance of deep-deposit feeders | | 39.6 | 22.0 | 53.3 | 59.4 | 63.6 | 55.4 |
| Tolerance Score | | 9.7 | 9.4 | 9.8 | 9.8 | 9.5 | 9.4 |

**Table 4. (Continued.)**

| Taxon | Common Name | 8A Rep 1 | 8A Rep 3 | 8A Rep 4 | 8B Rep 2 | 8B Rep 3 | 8B Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | | | | 1 | | 1 |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | 1 | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | 1 | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | | 4 | 1 | 3 | 2 | 2 |
| Ilyodrilus templetoni | tube worm | 2 | | 2 | 6 | 1 | 5 |
| Limnodrilus sp. | tube worm | 48 | 7 | 20 | 24 | 22 | 7 |
| Limnodrilus claparedeianus | tube worm | | 7 | 10 | 22 | 7 | 20 |
| Limnodrilus hoffmeisteri | tube worm | 38 | 66 | 35 | 19 | 15 | 20 |
| Limnodrilus udekemianus | tube worm | | | | | | |
| Quistadrilus multisetosus | tube worm | 2 | 4 | | 3 | 1 | 4 |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | 1 | | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | 2 | | | |
| Helobdella stagnalis | leech | | | 3 | | | |
| Batracobdella phalera | leech | | | 1 | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | 3 | 6 | 1 | 19 | 36 | 18 |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | | | | 1 | 1 |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | 2 | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | 1 | 4 | | |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | 1 |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | | | 1 | 6 | 3 | 1 |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | | | | | | |
| Tanypus neopunctipennis | midge | | | | 1 | 2 | |
| Total Specimens | | 93 | 94 | 80 | 109 | 91 | 80 |

| Metric | | | | | | |
|---|---|---|---|---|---|---|
| Total Taxa | 5 | 6 | 13 | 12 | 11 | 11 |
| Density (number per square meter) | 4,043 | 7,568 | 3,478 | 3,043 | 5,275 | 3,478 |
| Abundance of Pollution-indicative Taxa (%) | 92.5 | 85.1 | 81.3 | 59.6 | 48.4 | 58.8 |
| Abundance of deep-deposit feeders | 96.8 | 93.6 | 85.0 | 70.6 | 53.8 | 72.5 |
| Tolerance Score | 9.7 | 9.5 | 9.2 | 8.7 | 8.9 | 8.4 |

Table 4. (Continued.)

| Taxon | Common Name | 8C Rep 1 | 8C Rep 2 | 8C Rep 4 | 16 Rep 1 | 16 Rep 2 | 16 Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | | | | 3 | | |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | 2 | 3 | 2 | | | |
| Ilyodrilus templetoni | tube worm | | 1 | 1 | | | |
| Limnodrilus sp. | tube worm | 37 | 48 | 45 | 63 | 56 | 52 |
| Limnodrilus claparedeianus | tube worm | 8 | 9 | 22 | | | |
| Limnodrilus hoffmeisteri | tube worm | 53 | 35 | 23 | 35 | 30 | 40 |
| Limnodrilus udekemianus | tube worm | | | | | | |
| Quistadrilus multisetosus | tube worm | | | | | | |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | 2 | | | 2 | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | | | | |
| Batracobdella phalera | leech | | | | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | | | | | 1 | 1 |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | | | | | |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | | | |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | 2 | 1 | 1 |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | | | | 7 | 7 | 4 |
| Cladopelma sp. | midge | | | | 1 | 1 | 1 |
| Cryptochironomus fulvus gr. | midge | 2 | 2 | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | 1 | 1 |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | | | | 1 | 3 | 1 |
| Tanypus neopunctipennis | midge | | | | | | |
| Total Specimens | | 102 | 100 | 93 | 112 | 102 | 101 |

| Metric | 8C Rep 1 | 8C Rep 2 | 8C Rep 4 | 16 Rep 1 | 16 Rep 2 | 16 Rep 4 |
|---|---|---|---|---|---|---|
| Total Taxa | 5 | 7 | 5 | 7 | 9 | 8 |
| Density (number per square meter) | 3,174 | 2,522 | 4,043 | 1,304 | 1,609 | 1,217 |
| Abundance of Pollution-indicative Taxa (%) | 96.1 | 92.0 | 96.8 | 87.5 | 84.3 | 91.1 |
| Abundance of deep-deposit feeders | 98.0 | 96.0 | 100.0 | 87.5 | 84.3 | 91.1 |
| Tolerance Score | 9.7 | 9.7 | 9.8 | 9.7 | 9.6 | 9.7 |

**Table 4. (Continued.)**

| Taxon | Common Name | 17 Rep 2 | 17 Rep 3 | 17 Rep 4 | 18 Rep 1 | 18 Rep 2 | 18 Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | | 2 | | | | |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | 1 | | 1 |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | | | | 1 | 1 | 3 |
| Ilyodrilus templetoni | tube worm | | | 1 | 2 | | 3 |
| Limnodrilus sp. | tube worm | 42 | 46 | 43 | 62 | 36 | 54 |
| Limnodrilus claparedeianus | tube worm | | 16 | 19 | 22 | 36 | 19 |
| Limnodrilus hoffmeisteri | tube worm | 43 | 16 | 19 | 13 | 18 | 20 |
| Limnodrilus udekemianus | tube worm | | | | | | |
| Quistadrilus multisetosus | tube worm | | | | 3 | | 2 |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | | | | | | |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | | | | |
| Batracobdella phalera | leech | | | | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | 1 | | | 2 | 3 | 2 |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | | 2 | | | |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | | | |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | | | |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | 1 | | 1 | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | | | | 1 | 1 | 1 |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | 2 | 2 | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | | 1 | 1 | 2 | 1 | 1 |
| Tanypus neopunctipennis | midge | | | | | | |
| Total Specimens | | 87 | 81 | 86 | 111 | 98 | 106 |
| **Metric** | | | | | | | |
| Total Taxa | | 4 | 5 | 7 | 11 | 8 | 10 |
| Density (number per square meter) | | 6,304 | 3,522 | 3,739 | 2,522 | 4,304 | 565 |
| Abundance of Pollution-indicative Taxa (%) | | 97.7 | 96.3 | 94.2 | 87.4 | 91.8 | 87.7 |
| Abundance of deep-deposit feeders | | 97.7 | 96.3 | 95.3 | 93.7 | 92.9 | 96.2 |
| Tolerance Score | | 9.8 | 9.8 | 9.8 | 9.6 | 9.7 | 9.7 |

**Table 4. (Continued.)**

| Taxon | Common Name | 19 Rep 2 | 19 Rep 3 | 19 Rep 4 | 20 Rep 1 | 20 Rep 2 | 20 Rep 4 |
|---|---|---|---|---|---|---|---|
| Nematoda | round worms | | | | | | |
| Tricladida | | | | | | | |
| Planariidae | | | | | | | |
| Dugesia tigrina | flat worm | | | | | | |
| Megadrili | earth worms | | | | | | |
| Tubificida | | | | | | | |
| Enchytraeidae | earth worm | | | | | | |
| Naididae | | | | | | | |
| Dero sp. | naiad worm | | | | | | |
| Tubificinae | | | | | | | |
| Aulodrilus pigueti | tube worm | | | | | | |
| Aulodrilus limnobius | tube worm | | | | | | |
| Branchiura sowerbyi | tube worm | | | | | | |
| Ilyodrilus templetoni | tube worm | | | | | | |
| Limnodrilus sp. | tube worm | 89 | 65 | 44 | 48 | 50 | 52 |
| Limnodrilus claparedeianus | tube worm | | 4 | 20 | | | |
| Limnodrilus hoffmeisteri | tube worm | | 21 | 31 | 37 | 34 | 29 |
| Limnodrilus udekemianus | tube worm | | | 10 | | | |
| Quistadrilus multisetosus | tube worm | | | | 11 | 18 | 16 |
| Hirudinida | | | | | | | |
| Erpobdellidae | | | | | | | |
| Erpobdella punctata | leech | 1 | | | 2 | 1 | 1 |
| Glossophoniidae | | | | | | | |
| Helobdella elongata | leech | | | | | | |
| Helobdella stagnalis | leech | | | | | 1 | 2 |
| Batracobdella phalera | leech | | 1 | 1 | | | |
| Bivalvia | | | | | | | |
| Corbiculidae | | | | | | | |
| Corbicula fluminea | Asiatic clam | | | | | | |
| Pisidiidae | | | | | | | |
| Pisidium sp. | pill clam | | | | | | |
| Gastropoda | | | | | | | |
| Viviparidae | | | | | | | |
| Cipangopaludina japonica | mystery snail | | | | | | |
| Amphipoda | | | | | | | |
| Gammaridae | | | | | | | |
| Gammarus fasciatus | side swimmer | | | | 2 | 1 | 7 |
| Isopoda | | | | | | | |
| Asellidae | | | | | | | |
| Caecidotea sp. | water slater | | | | 2 | 1 | 1 |
| Diptera | | | | | | | |
| Cecidomyiidae | gall gnat | | | | | | |
| Ceratoponidae | | | | | | | |
| Ceratopogon sp. | sand fly | | | | | | |
| Bezzia/Palpomyia | sand fly | | | | | | |
| Chironomidae | | | | | | | |
| Chironomus decorus gr. | midge | | 3 | 1 | | | |
| Cladopelma sp. | midge | | | | | | |
| Cryptochironomus fulvus gr. | midge | | 1 | | | | |
| Orthocladius annectens | midge | | | | | | |
| Phaenopsectra obediens gr. | midge | | | | | | |
| Polypedilum flavum | midge | | | | | | |
| Polypedilum halterale gr. | midge | | | | | | |
| Procladius sp. | midge | 1 | 9 | 9 | | | |
| Tanypus neopunctipennis | midge | | | | | | |
| Total Specimens | | 91 | 104 | 116 | 102 | 106 | 108 |
| **Metric** | | | | | | | |
| Total Taxa | | 3 | 7 | 7 | 6 | 7 | 7 |
| Density (number per square meter) | | 8,792 | 2,913 | 5,043 | 261 | 7,681 | 391 |
| Abundance of Pollution-indicative Taxa (%) | | 97.8 | 86.5 | 90.5 | 83.3 | 79.2 | 75.0 |
| Abundance of deep-deposit feeders | | 97.8 | 86.5 | 90.5 | 94.1 | 96.2 | 89.8 |
| Tolerance Score | | 9.7 | 9.7 | 8.9 | 9.5 | 9.6 | 9.4 |

**Table 5. Percent composition by station for benthic macroinvertebrate taxa collected from the Anacostia River, June 2017.**

| Family | Taxon | Pollution-indicative Taxon | Deep-deposit Feeder | Tolerance Value | 6A | 6B | 6C | 6.5D |
|---|---|---|---|---|---|---|---|---|
| Asellidae | Caecidotea sp. | | | 2.6 | | | | |
| Cecidomyiidae | Cecidomyiidae | | | - | | | | |
| Ceratoponidae | Ceratopogon sp. | | | 2.7 | | | | |
| Ceratoponidae | Bezzia/Palpomyia | | | 3.3 | | | | |
| Chironomidae | Orthocladius annectens | | | 9.2 | 0.3 | | | |
| Chironomidae | Phaenopsectra obediens gr. | | | 6.8 | | | | |
| Chironomidae | Cladopelma sp. | | | 2.5 | | | | |
| Chironomidae | Polypedilum flavum | | | 6.7 | | | | |
| Chironomidae | Cryptochironomus fulvus gr. | | | 7.3 | | | | |
| Chironomidae | Polypedilum halterale gr. | | | 6.7 | | 0.3 | | |
| Chironomidae | Procladius sp. | | | 9.3 | 0.6 | 0.3 | | |
| Chironomidae | Tanypus neopunctipennis | | | 9.6 | | | 6.5 | 8.7 |
| Chironomidae | Chironomus decorus gr. | | | 9.8 | 0.6 | 0.9 | 4.2 | 29.9 |
| Corbiculidae | Corbicula fluminea | | | 6.3 | 11.4 | 20.5 | 2.6 | |
| Enchytraeidae | Enchytraeidae | | x | 10 | | | | |
| Erpobdellidae | Erpobdella punctata | | | 8 | | 0.3 | | |
| Gammaridae | Gammarus fasciatus | | | 6.7 | | | | |
| Glossophoniidae | Helobdella elongata | | | 6 | | | | |
| Glossophoniidae | Batracobdella phalera | | | 6 | | | 1.3 | |
| Glossophoniidae | Helobdella stagnalis | | | 6 | 2.4 | 1.9 | 1.3 | |
| Megadrili | Megadrili | | x | 10 | | | | |
| Naididae | Dero sp. | | x | 10 | | 0.3 | | |
| Nematoda | Nematoda | | | - | 0.3 | | | 33.4 |
| Pisidiidae | Pisidium sp. | | | 7.7 | 1.5 | 0.3 | | 2.0 |
| Planariidae | Dugesia tigrina | | | 9.3 | | | | |
| Tubificinae | Aulodrilus limnobius | | x | 5.2 | 0.6 | 0.3 | | |
| Tubificinae | Aulodrilus pigueti | | x | 4.7 | | 0.6 | | |
| Tubificinae | Branchiura sowerbyi | | x | 8.4 | 0.9 | 0.6 | 2.0 | |
| Tubificinae | Limnodrilus udekemianus | x | x | 9.7 | 1.2 | 8.4 | | |
| Tubificinae | Quistadrilus multisetosus | | x | 9.4 | 1.8 | 2.5 | 2.0 | |
| Tubificinae | Ilyodrilus templetoni | | x | 9.4 | 4.8 | 4.7 | 0.7 | 2.0 |
| Tubificinae | Limnodrilus claparedeianus | x | x | 10 | 6.6 | 8.1 | 7.2 | 0.3 |
| Tubificinae | Limnodrilus hoffmeisteri | x | x | 9.8 | 42.6 | 8.4 | 14.3 | 9.9 |
| Tubificinae | Limnodrilus sp. | x | x | 9.8 | 23.7 | 41.6 | 58.0 | 13.7 |
| Viviparidae | Cipangopaludina japonica | | | - | 0.6 | | | |

**Table 5. (Continued.)**

| Family | Taxon | Pollution-indicative Taxon | Deep-deposit Feeder | Tolerance Value | 6.5E | 7A | 7B | 7D |
|---|---|---|---|---|---|---|---|---|
| Asellidae | Caecidotea sp. | | | 2.6 | | | | |
| Cecidomyiidae | Cecidomyiidae | | | - | | | | |
| Ceratoponidae | Ceratopogon sp. | | | 2.7 | | | | 0.3 |
| Ceratoponidae | Bezzia/Palpomyia | | | 3.3 | | | | |
| Chironomidae | Orthocladius annectens | | | 9.2 | | | | |
| Chironomidae | Phaenopsectra obediens gr. | | | 6.8 | | | | |
| Chironomidae | Cladopelma sp. | | | 2.5 | | | | |
| Chironomidae | Polypedilum flavum | | | 6.7 | | | | |
| Chironomidae | Cryptochironomus fulvus gr. | | | 7.3 | | | | |
| Chironomidae | Polypedilum halterale gr. | | | 6.7 | 1.3 | | | |
| Chironomidae | Procladius sp. | | | 9.3 | | 0.3 | | 0.3 |
| Chironomidae | Tanypus neopunctipennis | | | 9.6 | 9.4 | | 0.3 | 7.6 |
| Chironomidae | Chironomus decorus gr. | | | 9.8 | 29.9 | | 1.4 | 35.2 |
| Corbiculidae | Corbicula fluminea | | | 6.3 | | 17.8 | 13.5 | |
| Enchytraeidae | Enchytraeidae | | x | 10 | | 2.9 | | |
| Erpobdellidae | Erpobdella punctata | | | 8 | | 0.6 | | |
| Gammaridae | Gammarus fasciatus | | | 6.7 | | 0.6 | | |
| Glossophoniidae | Helobdella elongata | | | 6 | | | | |
| Glossophoniidae | Batracobdella phalera | | | 6 | | 0.3 | | |
| Glossophoniidae | Helobdella stagnalis | | | 6 | | 1.3 | | |
| Megadrili | Megadrili | | x | 10 | | 0.3 | | |
| Naididae | Dero sp. | | x | 10 | 0.3 | | | |
| Nematoda | Nematoda | | | - | 23.3 | 0.3 | | 34.9 |
| Pisidiidae | Pisidium sp. | | | 7.7 | 0.6 | 2.3 | 1.4 | 0.3 |
| Planariidae | Dugesia tigrina | | | 9.3 | | | | |
| Tubificinae | Aulodrilus limnobius | | x | 5.2 | | | | |
| Tubificinae | Aulodrilus pigueti | | x | 4.7 | | | | |
| Tubificinae | Branchiura sowerbyi | | x | 8.4 | 0.3 | 1.9 | 2.4 | 1.5 |
| Tubificinae | Limnodrilus udekemianus | x | x | 9.7 | | 1.9 | 10.0 | 2.4 |
| Tubificinae | Quistadrilus multisetosus | | x | 9.4 | | 2.6 | 1.0 | |
| Tubificinae | Ilyodrilus templetoni | | x | 9.4 | 1.9 | 4.9 | 8.0 | 2.1 |
| Tubificinae | Limnodrilus claparedeianus | x | x | 10 | 2.8 | 10.4 | 13.1 | 4.6 |
| Tubificinae | Limnodrilus hoffmeisteri | x | x | 9.8 | | 24.9 | 21.5 | 2.1 |
| Tubificinae | Limnodrilus sp. | x | x | 9.8 | 30.2 | 26.2 | 27.0 | 8.6 |
| Viviparidae | Cipangopaludina japonica | | | - | | 0.3 | 0.3 | |

Table 5. (Continued.)

| Family | Taxon | Pollution-indicative Taxon | Deep-deposit Feeder | Tolerance Value | 7E | 7F | 7.5D | 7.5E |
|---|---|---|---|---|---|---|---|---|
| Asellidae | Caecidotea sp. | | | 2.6 | | | | |
| Cecidomyiidae | Cecidomyiidae | | | - | | | | |
| Ceratoponidae | Ceratopogon sp. | | | 2.7 | | | | 0.3 |
| Ceratoponidae | Bezzia/Palpomyia | | | 3.3 | | | 1.4 | |
| Chironomidae | Orthocladius annectens | | | 9.2 | | | | |
| Chironomidae | Phaenopsectra obediens gr. | | | 6.8 | | | | |
| Chironomidae | Cladopelma sp. | | | 2.5 | | | | |
| Chironomidae | Polypedilum flavum | | | 6.7 | | | | |
| Chironomidae | Cryptochironomus fulvus gr. | | | 7.3 | | | | |
| Chironomidae | Polypedilum halterale gr. | | | 6.7 | | | | |
| Chironomidae | Procladius sp. | | | 9.3 | 0.3 | | 1.0 | |
| Chironomidae | Tanypus neopunctipennis | | | 9.6 | 8.9 | 0.6 | 29.0 | 9.5 |
| Chironomidae | Chironomus decorus gr. | | | 9.8 | 23.9 | 15.1 | 25.6 | 26.5 |
| Corbiculidae | Corbicula fluminea | | | 6.3 | | | 0.3 | |
| Enchytraeidae | Enchytraeidae | | x | 10 | | | | |
| Erpobdellidae | Erpobdella punctata | | | 8 | | | | |
| Gammaridae | Gammarus fasciatus | | | 6.7 | | | | 0.3 |
| Glossophoniidae | Helobdella elongata | | | 6 | | | | |
| Glossophoniidae | Batracobdella phalera | | | 6 | | | | |
| Glossophoniidae | Helobdella stagnalis | | | 6 | | | | |
| Megadrili | Megadrili | | x | 10 | | | | |
| Naididae | Dero sp. | | x | 10 | | | | |
| Nematoda | Nematoda | | | - | 21.2 | 29.3 | 4.4 | 2.7 |
| Pisidiidae | Pisidium sp. | | | 7.7 | | | 0.3 | 1.2 |
| Planariidae | Dugesia tigrina | | | 9.3 | | | | |
| Tubificinae | Aulodrilus limnobius | | x | 5.2 | | | | |
| Tubificinae | Aulodrilus pigueti | | x | 4.7 | | | | |
| Tubificinae | Branchiura sowerbyi | | x | 8.4 | 0.3 | | 0.7 | 0.6 |
| Tubificinae | Limnodrilus udekemianus | x | x | 9.7 | 1.7 | | 1.4 | |
| Tubificinae | Quistadrilus multisetosus | | x | 9.4 | | | | |
| Tubificinae | Ilyodrilus templetoni | | x | 9.4 | 4.4 | | 2.0 | 2.4 |
| Tubificinae | Limnodrilus claparedeianus | x | x | 10 | 10.6 | 7.1 | 2.7 | 11.0 |
| Tubificinae | Limnodrilus hoffmeisteri | x | x | 9.8 | 14.3 | 15.1 | 12.6 | 14.3 |
| Tubificinae | Limnodrilus sp. | x | x | 9.8 | 14.3 | 32.8 | 18.4 | 31.1 |
| Viviparidae | Cipangopaludina japonica | | | - | | | | |

**Table 5. (Continued.)**

| Family | Taxon | Pollution-indicative Taxon | Deep-deposit Feeder | Tolerance Value | 8A | 8B | 8C | 16 |
|---|---|---|---|---|---|---|---|---|
| Asellidae | Caecidotea sp. | | | 2.6 | | 0.4 | | |
| Cecidomyiidae | Cecidomyiidae | | | - | | | | 1.3 |
| Ceratoponidae | Ceratopogon sp. | | | 2.7 | | | | |
| Ceratoponidae | Bezzia/Palpomyia | | | 3.3 | | | | |
| Chironomidae | Orthocladius annectens | | | 9.2 | | | | |
| Chironomidae | Phaenopsectra obediens gr. | | | 6.8 | | | | 0.6 |
| Chironomidae | Cladopelma sp. | | | 2.5 | | | | 1.0 |
| Chironomidae | Polypedilum flavum | | | 6.7 | | | | |
| Chironomidae | Cryptochironomus fulvus gr. | | | 7.3 | | | 1.4 | |
| Chironomidae | Polypedilum halterale gr. | | | 6.7 | | | | |
| Chironomidae | Procladius sp. | | | 9.3 | | | | 1.6 |
| Chironomidae | Tanypus neopunctipennis | | | 9.6 | | 1.1 | | |
| Chironomidae | Chironomus decorus gr. | | | 9.8 | 0.4 | 3.6 | | 5.7 |
| Corbiculidae | Corbicula fluminea | | | 6.3 | 3.7 | 26.1 | | 0.6 |
| Enchytraeidae | Enchytraeidae | | x | 10 | | | | |
| Erpobdellidae | Erpobdella punctata | | | 8 | | 0.4 | 0.7 | 0.6 |
| Gammaridae | Gammarus fasciatus | | | 6.7 | 0.4 | 1.4 | | |
| Glossophoniidae | Helobdella elongata | | | 6 | 0.7 | | | |
| Glossophoniidae | Batracobdella phalera | | | 6 | 0.4 | | | |
| Glossophoniidae | Helobdella stagnalis | | | 6 | 1.1 | | | |
| Megadrili | Megadrili | | x | 10 | | | | |
| Naididae | Dero sp. | | x | 10 | | 0.4 | | |
| Nematoda | Nematoda | | | - | | 0.7 | | 1.0 |
| Pisidiidae | Pisidium sp. | | | 7.7 | | 0.7 | | |
| Planariidae | Dugesia tigrina | | | 9.3 | 0.4 | | | |
| Tubificinae | Aulodrilus limnobius | | x | 5.2 | | | | |
| Tubificinae | Aulodrilus pigueti | | x | 4.7 | | | | |
| Tubificinae | Branchiura sowerbyi | | x | 8.4 | 1.9 | 2.5 | 2.4 | |
| Tubificinae | Limnodrilus udekemianus | x | x | 9.7 | | | | |
| Tubificinae | Quistadrilus multisetosus | | x | 9.4 | 2.2 | 2.9 | | |
| Tubificinae | Ilyodrilus templetoni | | x | 9.4 | 1.5 | 4.3 | 0.7 | |
| Tubificinae | Limnodrilus claparedeianus | x | x | 10 | 6.4 | 17.5 | 13.2 | |
| Tubificinae | Limnodrilus hoffmeisteri | x | x | 9.8 | 52.1 | 19.3 | 37.6 | 33.3 |
| Tubificinae | Limnodrilus sp. | x | x | 9.8 | 28.1 | 18.9 | 44.1 | 54.3 |
| Viviparidae | Cipangopaludina japonica | | | - | 0.7 | | | |

Table 5. (Continued.)

| Family | Taxon | Pollution-indicative Taxon | Deep-deposit Feeder | Tolerance Value | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|
| Asellidae | Caecidotea sp. | | | 2.6 | | | | 1.3 |
| Cecidomyiidae | Cecidomyiidae | | | - | 0.8 | | | |
| Ceratoponidae | Ceratopogon sp. | | | 2.7 | | | | |
| Ceratoponidae | Bezzia/Palpomyia | | | 3.3 | | | | |
| Chironomidae | Orthocladius annectens | | | 9.2 | | | | |
| Chironomidae | Phaenopsectra obediens gr. | | | 6.8 | | | | |
| Chironomidae | Cladopelma sp. | | | 2.5 | | | | |
| Chironomidae | Polypedilum flavum | | | 6.7 | | 1.3 | | |
| Chironomidae | Cryptochironomus fulvus gr. | | | 7.3 | | | 0.3 | |
| Chironomidae | Polypedilum halterale gr. | | | 6.7 | | | | |
| Chironomidae | Procladius sp. | | | 9.3 | 0.8 | 1.3 | 6.1 | |
| Chironomidae | Tanypus neopunctipennis | | | 9.6 | | | | |
| Chironomidae | Chironomus decorus gr. | | | 9.8 | | 1.0 | 1.3 | |
| Corbiculidae | Corbicula fluminea | | | 6.3 | 0.4 | 2.2 | | |
| Enchytraeidae | Enchytraeidae | | x | 10 | | | | |
| Erpobdellidae | Erpobdella punctata | | | 8 | | | 0.3 | 1.3 |
| Gammaridae | Gammarus fasciatus | | | 6.7 | | | | 3.2 |
| Glossophoniidae | Helobdella elongata | | | 6 | | | | |
| Glossophoniidae | Batracobdella phalera | | | 6 | | | 0.6 | |
| Glossophoniidae | Helobdella stagnalis | | | 6 | | | | 0.9 |
| Megadrili | Megadrili | | x | 10 | | | | |
| Naididae | Dero sp. | | x | 10 | | | | |
| Nematoda | Nematoda | | | - | 0.8 | | | |
| Pisidiidae | Pisidium sp. | | | 7.7 | 0.8 | | | |
| Planariidae | Dugesia tigrina | | | 9.3 | | | | |
| Tubificinae | Aulodrilus limnobius | | x | 5.2 | | | | |
| Tubificinae | Aulodrilus pigueti | | x | 4.7 | | 0.6 | | |
| Tubificinae | Branchiura sowerbyi | | x | 8.4 | | 1.6 | | |
| Tubificinae | Limnodrilus udekemianus | x | x | 9.7 | | | 3.2 | |
| Tubificinae | Quistadrilus multisetosus | | x | 9.4 | | 1.6 | | 14.2 |
| Tubificinae | Ilyodrilus templetoni | | x | 9.4 | 0.4 | 1.6 | | |
| Tubificinae | Limnodrilus claparedeianus | x | x | 10 | 13.8 | 24.4 | 7.7 | |
| Tubificinae | Limnodrilus hoffmeisteri | x | x | 9.8 | 30.7 | 16.2 | 16.7 | 31.6 |
| Tubificinae | Limnodrilus sp. | x | x | 9.8 | 51.6 | 48.3 | 63.7 | 47.5 |
| Viviparidae | Cipangopaludina japonica | | | - | | | | |

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**Table 6. Percent contribution of the three dominant taxa by Station (all replicates combined) for benthic macroinvertebrates collected from the Anacostia River, June 2017.**

| | Percent Contribution of Dominant Taxon 1 | | Percent Contribution of Dominant Taxon 2 | |
|---|---|---|---|---|
| Station | Percent Composition | Taxon | Percent Composition | Taxon |
| 16 | 54.3 | Limnodrilus sp. | 33.3 | Limnodrilus hoffmeisteri |
| 17 | 51.6 | Limnodrilus sp. | 30.7 | Limnodrilus hoffmeisteri |
| 18 | 48.3 | Limnodrilus sp. | 24.4 | Limnodrilus claparedeianus |
| 19 | 63.7 | Limnodrilus sp. | 16.7 | Limnodrilus hoffmeisteri |
| 20 | 47.5 | Limnodrilus sp. | 31.6 | Limnodrilus hoffmeisteri |
| 6.5D | 33.4 | Nematoda | 29.9 | Chironomus decorus gr. |
| 6.5E | 30.2 | Limnodrilus sp. | 29.9 | Chironomus decorus gr. |
| 6A | 42.6 | Limnodrilus hoffmeisteri | 23.7 | Limnodrilus sp. |
| 6B | 41.6 | Limnodrilus sp. | 20.5 | Corbicula fluminea |
| 6C | 58.0 | Limnodrilus sp. | 14.3 | Limnodrilus hoffmeisteri |
| 7.5D | 29.0 | Tanypus neopunctipennis | 25.6 | Chironomus decorus gr. |
| 7.5E | 31.1 | Limnodrilus sp. | 26.5 | Chironomus decorus gr. |
| 7A | 26.2 | Limnodrilus sp. | 24.9 | Limnodrilus hoffmeisteri |
| 7B | 27.0 | Limnodrilus sp. | 21.5 | Limnodrilus hoffmeisteri |
| 7D | 35.2 | Chironomus decorus gr. | 34.9 | Nematoda |
| 7E | 23.9 | Chironomus decorus gr. | 21.2 | Nematoda |
| 7F | 32.8 | Limnodrilus sp. | 29.3 | Nematoda |
| 8A | 52.1 | Limnodrilus hoffmeisteri | 28.1 | Limnodrilus sp. |
| 8B | 26.1 | Corbicula fluminea | 19.3 | Limnodrilus hoffmeisteri |
| 8C | 44.1 | Limnodrilus sp. | 37.6 | Limnodrilus hoffmeisteri |

**Table 6. (Continued.)**

| Station | Percent Contributionn of Dominant Taxon 3 | | Total Percent Contribution of 3 Dominant Taxa |
|---|---|---|---|
| | Percent Composition | Taxon | |
| 16 | 5.7 | Chironomus decorus gr. | 93.3 |
| 17 | 13.8 | Limnodrilus claparedeianus | 96.1 |
| 18 | 16.2 | Limnodrilus hoffmeisteri | 88.9 |
| 19 | 7.7 | Limnodrilus claparedeianus | 88.1 |
| 20 | 14.2 | Quistadrilus multisetosus | 93.4 |
| 6.5D | 13.7 | Limnodrilus sp. | 77.0 |
| 6.5E | 23.3 | Nematoda | 83.3 |
| 6A | 11.4 | Corbicula fluminea | 77.8 |
| 6B | 8.4 | Limnodrilus udekemianus | 70.5 |
| 6C | 7.2 | Limnodrilus claparedeianus | 79.5 |
| 7.5D | 18.4 | Limnodrilus sp. | 73.0 |
| 7.5E | 14.3 | Limnodrilus hoffmeisteri | 72.0 |
| 7A | 17.8 | Corbicula fluminea | 68.9 |
| 7B | 13.5 | Corbicula fluminea | 61.9 |
| 7D | 8.6 | Limnodrilus sp. | 78.6 |
| 7E | 14.3 | Limnodrilus hoffmeisteri | 59.4 |
| 7F | 15.1 | Chironomus decorus gr. | 77.2 |
| 8A | 6.4 | Limnodrilus claparedeianus | 86.5 |
| 8B | 18.9 | Limnodrilus sp. | 64.3 |
| 8C | 13.2 | Limnodrilus claparedeianus | 94.9 |

**Table 7. Spearman's Rank Correlation Coefficients for benthic macroinvertebrate stations in the Anacostia River, June 2017.**

| | 6A | 6B | 6C | 6.5D | 6.5E | 7A | 7B | 7D | 7E | 7F | 7.5D | 7.5E | 8A | 8B | 8C | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6B** | 0.63 | | | | | | | | | | | | | | | | | | |
| **6C** | 0.639 | 0.886 | | | | | | | | | | | | | | | | | |
| **6.5D** | **0.228** | **0.193** | **0.312** | | | | | | | | | | | | | | | | |
| **6.5E** | **0.217** | 0.483 | 0.617 | 0.886 | | | | | | | | | | | | | | | |
| **7A** | 0.919 | 0.851 | 0.763 | **0.196** | **0.307** | | | | | | | | | | | | | | |
| **7B** | 0.862 | 0.879 | 0.785 | **0.209** | **0.356** | 0.956 | | | | | | | | | | | | | |
| **7D** | **0.037** | **0.086** | **0.169** | 0.968 | 0.856 | **0.037** | **0.081** | | | | | | | | | | | | |
| **7E** | 0.441 | **0.34** | 0.46 | 0.927 | 0.861 | 0.413 | 0.457 | 0.885 | | | | | | | | | | | |
| **7F** | 0.539 | 0.6 | 0.72 | 0.824 | 0.863 | 0.575 | 0.591 | 0.721 | 0.855 | | | | | | | | | | |
| **7.5D** | **0.369** | **0.345** | 0.526 | 0.661 | 0.733 | 0.348 | **0.38** | 0.593 | 0.755 | 0.549 | | | | | | | | | |
| **7.5E** | 0.57 | 0.641 | 0.795 | 0.646 | 0.825 | 0.616 | 0.662 | 0.567 | 0.808 | 0.767 | 0.825 | | | | | | | | |
| **8A** | 0.982 | 0.557 | 0.645 | **0.24** | **0.223** | 0.856 | 0.804 | **0.041** | 0.449 | 0.554 | **0.385** | 0.581 | | | | | | | |
| **8B** | 0.774 | 0.777 | 0.586 | **0.181** | **0.267** | 0.921 | 0.872 | **0.091** | 0.407 | 0.463 | **0.311** | 0.544 | 0.671 | | | | | | |
| **8C** | 0.896 | 0.754 | 0.873 | **0.265** | 0.409 | 0.883 | 0.878 | **0.086** | 0.49 | 0.688 | 0.436 | 0.729 | 0.918 | 0.69 | | | | | |
| **16** | 0.821 | 0.802 | 0.933 | **0.35** | 0.538 | 0.828 | 0.818 | **0.163** | 0.496 | 0.737 | 0.499 | 0.773 | 0.842 | 0.599 | 0.954 | | | | |
| **17** | 0.825 | 0.824 | 0.938 | **0.278** | 0.483 | 0.865 | 0.872 | **0.11** | 0.485 | 0.724 | 0.442 | 0.758 | 0.84 | 0.674 | 0.984 | 0.968 | | | |
| **18** | 0.674 | 0.853 | 0.93 | **0.231** | 0.506 | 0.808 | 0.848 | **0.12** | 0.466 | 0.69 | 0.401 | 0.758 | 0.674 | 0.695 | 0.901 | 0.864 | 0.95 | | |
| **19** | 0.645 | 0.878 | 0.984 | **0.268** | 0.566 | 0.756 | 0.789 | **0.124** | 0.415 | 0.712 | 0.432 | 0.747 | 0.656 | 0.557 | 0.884 | 0.941 | 0.948 | 0.934 | |
| **20** | 0.818 | 0.769 | 0.895 | **0.261** | 0.437 | 0.818 | 0.791 | **0.069** | 0.408 | 0.668 | 0.419 | 0.684 | 0.844 | 0.584 | 0.931 | 0.96 | 0.937 | 0.833 | 0.897 |

Bolded values indicate low correlation

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**Table 8. Summary statistics (mean and standard deviation) for metrics calculated from combined background and near-site benthic macroinvertebrate stations collected from the Anacostia River, June 2017.**

| Metric | Statistic [1] | Background | Near-Site |
|---|---|---|---|
| Taxa Richness | Mean | 7.07 | 8.44 |
| | St. Dev. | 2.09 | 2.55 |
| | Sample Replicates | 15 | 45 |
| Density (#/$m^2$) | Mean | 3344.60 [a] | 12905.70 [a] |
| | St. Dev. | 2669.40 | 14614.00 |
| | Sample Replicates | 15 | 45 |
| Tolerance Score | Mean | 9.60 | 9.32 |
| | St. Dev. | 0.22 | 0.60 |
| | Sample Replicates | 15 | 45 |
| Pollution Indicative Taxa (%) | Mean | 88.70 [a] | 57.04 [a] |
| | St. Dev. | 6.57 | 24.79 |
| | Sample Replicates | 15 | 45 |
| Deep-deposit Feeders (%) | Mean | 92.67 [a] | 62.50 [a] |
| | St. Dev. | 4.22 | 26.28 |
| | Sample Replicates | 15 | 45 |

[1] Two sample T-test calculated to determine if means differ between background and near-site stations

[a] Means significantly different at p-value < 0.05

Table 9. Descriptive statistics (mean and standard deviation) for metrics caculated from benthic macroinvertebrate samples collected at each station from the Anacostia River, June 2017.

| Station | Taxa Richness | | Density | | Tolerance Score | | Pollution Indicative Taxa (%) | | Deep-deposit Feeders (%) | | Sample Replicates |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. | |
| 16 | 8.0 | 1.0 | 1,376.8 | 205.5 | 9.7 | 0.1 | 87.6 | 3.4 | 87.6 | 3.4 | 3 |
| 17 | 5.3 | 1.5 | 4,521.7 | 1,547.6 | 9.8 | 0.0 | 96.1 | 1.8 | 96.4 | 1.2 | 3 |
| 18 | 9.7 | 1.5 | 2,463.8 | 1,870.2 | 9.7 | 0.0 | 89.0 | 2.5 | 94.3 | 1.8 | 3 |
| 19 | 5.7 | 2.3 | 5,582.9 | 2,976.5 | 9.4 | 0.4 | 91.6 | 5.7 | 91.6 | 5.7 | 3 |
| 20 | 6.7 | 0.6 | 2,777.8 | 4,247.0 | 9.5 | 0.1 | 79.2 | 4.2 | 93.4 | 3.3 | 3 |
| 6.5D | 6.7 | 0.6 | 44,862.0 | 10,353.4 | 9.7 | 0.0 | 23.4 | 8.9 | 25.5 | 8.5 | 3 |
| 6.5E | 6.7 | 0.6 | 19,206.2 | 10,926.9 | 9.7 | 0.1 | 33.3 | 9.5 | 35.8 | 9.7 | 3 |
| 6A | 10.3 | 3.2 | 10,597.1 | 3,923.9 | 9.0 | 0.3 | 74.5 | 7.9 | 82.6 | 8.7 | 3 |
| 6B | 10.7 | 2.1 | 7,013.9 | 1,938.7 | 8.9 | 0.2 | 66.3 | 4.1 | 74.8 | 7.0 | 3 |
| 6C | 9.3 | 1.2 | 1,217.4 | 419.3 | 9.6 | 0.0 | 79.5 | 4.3 | 84.0 | 2.4 | 3 |
| 7.5D | 8.3 | 1.2 | 7,409.2 | 4,476.3 | 9.6 | 0.2 | 35.5 | 14.5 | 38.3 | 15.7 | 3 |
| 7.5E | 8.7 | 1.5 | 4,675.4 | 3,017.8 | 9.5 | 0.2 | 56.4 | 2.4 | 59.5 | 4.1 | 3 |
| 7A | 11.3 | 3.1 | 5,709.3 | 274.7 | 7.8 | 0.8 | 63.8 | 5.4 | 76.2 | 8.4 | 3 |
| 7B | 8.7 | 0.6 | 5,440.7 | 716.0 | 8.9 | 0.4 | 71.0 | 9.1 | 82.0 | 11.4 | 3 |
| 7D | 9.0 | 1.7 | 32,432.7 | 21,835.0 | 9.7 | 0.0 | 17.8 | 7.6 | 21.4 | 7.6 | 3 |
| 7E | 7.3 | 2.1 | 13,632.5 | 3,504.6 | 9.8 | 0.1 | 40.8 | 18.3 | 45.6 | 16.3 | 3 |
| 7F | 4.7 | 0.6 | 29,180.1 | 20,943.0 | 9.8 | 0.0 | 56.4 | 37.0 | 56.4 | 37.0 | 3 |
| 8A | 8.0 | 4.4 | 5,030.1 | 2,216.4 | 9.5 | 0.3 | 86.3 | 5.7 | 91.8 | 6.1 | 3 |
| 8B | 11.3 | 0.6 | 3,932.4 | 1,183.2 | 8.7 | 0.3 | 55.6 | 6.3 | 65.7 | 10.3 | 3 |
| 8C | 5.7 | 1.2 | 3,246.4 | 763.5 | 9.7 | 0.1 | 95.0 | 2.6 | 98.0 | 2.0 | 3 |

**Table 10. Results of one way ANOVA analysis for B-IBI metrics and total taxa calculated for benthic macroinvertebrate samples collected from Anacostia River, June 2017.**

| Metric | F-value | P-value | Tukey Test Results [1] | |
|---|---|---|---|---|
| Taxa Richness | 3.45 | <0.001 | 17 vs 7A, 8B | |
| | | | 6B vs 7F | |
| | | | 7A vs 7F | |
| Abundance ($\#/m^2$) [1] | 6.89 | <0.001 | 16 vs 6.5D, 6.5E, 7E, 7F, 7D | 6.5D vs 6C, 7.5E, 8A, 8B, 8C |
| | | | 17 vs 6.5D | 6.5E vs 6C |
| | | | 18 vs 6.5D, 6.5E, 7D, 7F | 6A vs 6C |
| | | | 19 vs 6.5D | 6C vs 7D, 7E, 7F |
| | | | 20 vs 6.5D, 6.5E, 6A, 7D, 7E, 7F | |
| Tolerance Score | 11.29 | <0.001 | 16 vs 7A, 8B | 7.5D vs 7A, 8B |
| | | | 17 vs 6B, 7A, 7B, 8B | 7.5D vs 7A, 8B |
| | | | 18 vs 7A, 8B | 7.5E vs 7A, 8B |
| | | | 19 vs 7A | 7A vs 7B, 7D, 7E, 7F, 8A, 8B, 8C |
| | | | 20 vs 7A, 8B | 7B vs 7D, 7E, 7F, 8C |
| | | | 6.5D vs7A, 7B, 8B | 7D vs 8B |
| | | | 6.5E vs 6B, 7A, 7B, 8B | 7E vs 8B |
| | | | 6A vs 7A | 7F vs 8B |
| | | | 6B vs 7A, 7E, 7F, 8C | 8B vs 8C |
| | | | 6C vs 7A, 8B | |
| Deep-deposit Feeder (%) | 13.88 | <0.001 | 16 vs 6.5D, 6.5E, 7.5D, 7D, 7E | 6C vs 7.5D, 7D |
| | | | 17 vs 6.5D, 6.5E, 7.5D, 7.5E, 7D, 7E, 7F, 8B | 7.5D vs 7B, 8A, 8C |
| | | | 18 vs 6.5D, 6.5E, 7.5D, 7.5E, 7D, 7E, 7F | 7.5E vs 8C |
| | | | 19 vs 6.5D, 6.5E, 7.5D, 7D, 7E | 7A vs 7D, 8C |
| | | | 20 vs 6.5D, 6.5E, 7.5D, 7.5E, 7D, 7E, 7F | 7B vs 7D |
| | | | 6.5D vs 6A, 6B, 6C, 7A, 7B, 8A, 8C | 7D vs 8A, 8B, 8C |
| | | | 6.5E vs 6A, 6C, 7B, 8A, 8C | 7E vs 8A, 8C |
| | | | 6A vs 7.5D, 7D | 7F vs 8C |
| | | | 6B vs 7D, 8C | 8B vs 8C |
| Pollution Indicative Taxa (%) | 14 | <0.001 | 16 vs 6.5D, 6.5E, 7.5D, 7D, 7E | 6C vs7.5D, 7D, 7E |
| | | | 17 vs 6.5D, 6.5E, 6B, 7.5D, 7.5E, 7A, 7D, 7E, 7F, 8B | 7.5D vs 8A, 8C |
| | | | 18 vs 6.5D, 6.5E, 7.5D, 7D, 7E, 8B | 7.5E vs 8C |
| | | | 19 vs 6.5D, 6.5E, 7.5D, 7.5E, 7D, 7E, 7F, 8B | 7A vs 7D, 8C |
| | | | 20 vs 6.5D, 6.5E, 7.5D, 7.5E, 7D | 7B vs 7D |
| | | | 6.5D vs 6A, 6B, 6C, 7B, 8A, 8C | 7D vs 7F, 7A, 8C |
| | | | 6.5E vs 6A, 6C, 7B, 8A, 8C | 7E vs 8C |
| | | | 6A vs 7D | 7F vs 8C |
| | | | 6B vs 7D | 8B vs 8C |

[1] Station pairs that are significantly different

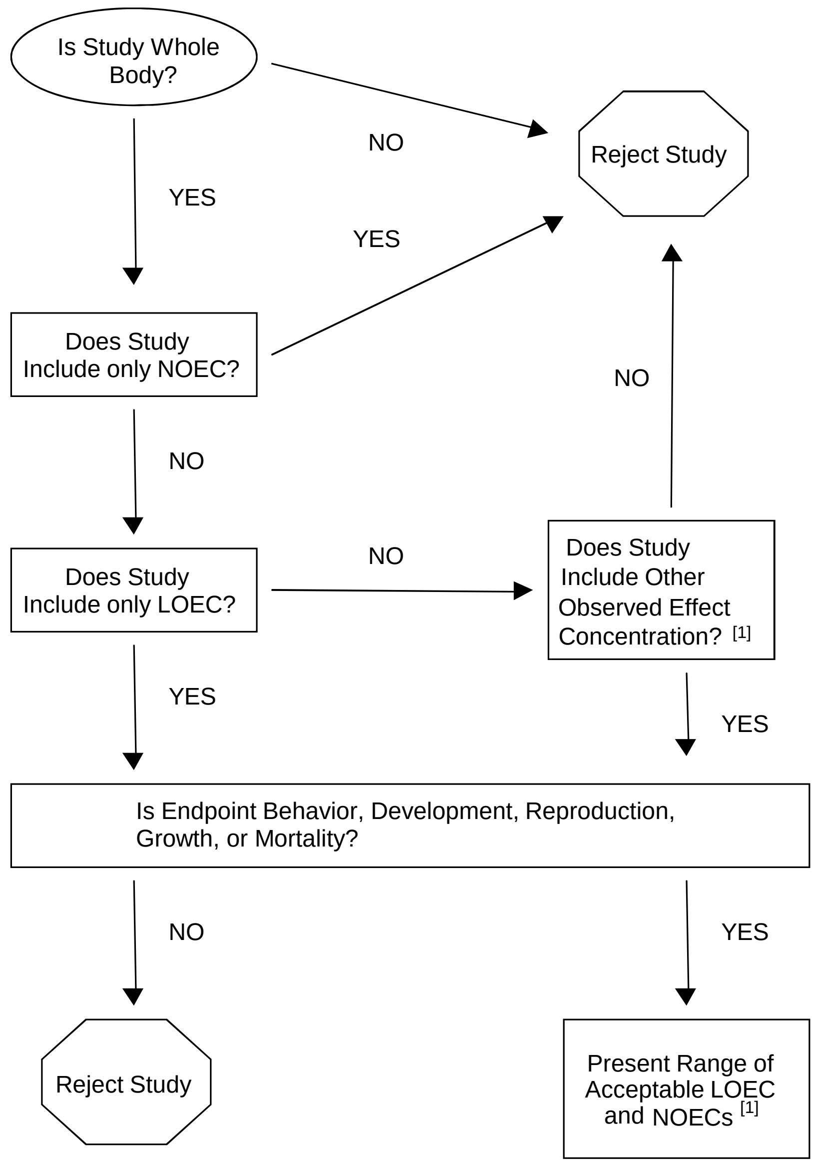
**Table 11. Descriptive statistics for B-IBI scores calculated for benthic macroinvertebrates collected from the Anacostia River, June 2017.**

| Station | Mean | Standard Deviation | Minimum | Maximum | Sample Replicates |
|---|---|---|---|---|---|
| 16 | 2.67 | 0.29 | 2.5 | 3 | 3 |
| 17 | 1.67 | 0.58 | 1 | 2 | 3 |
| 18 | 1.83 | 0.76 | 1 | 2.5 | 3 |
| 19 | 2.17 | 1.04 | 1 | 3 | 3 |
| 20 | 1.83 | 0.29 | 1.5 | 2 | 3 |
| 6.5D | 3.00 | 0.00 | 3 | 3 | 3 |
| 6.5E | 2.83 | 0.29 | 2.5 | 3 | 3 |
| 6A | 2.33 | 0.29 | 2 | 2.5 | 3 |
| 6B | 2.83 | 0.58 | 2.5 | 3.5 | 3 |
| 6C | 2.67 | 0.58 | 2 | 3 | 3 |
| 7.5D | 3.17 | 0.29 | 3 | 3.5 | 3 |
| 7.5E | 3.00 | 0.50 | 2.5 | 3.5 | 3 |
| 7A | 3.17 | 0.76 | 2.5 | 4 | 3 |
| 7B | 2.83 | 0.29 | 2.5 | 3 | 3 |
| 7D | 3.00 | 0.00 | 3 | 3 | 3 |
| 7E | 2.67 | 0.29 | 2.5 | 3 | 3 |
| 7F | 2.33 | 0.76 | 1.5 | 3 | 3 |
| 8A | 2.33 | 1.04 | 1.5 | 3.5 | 3 |
| 8B | 3.50 | 0.00 | 3.5 | 3.5 | 3 |
| 8C | 1.83 | 0.29 | 1.5 | 2 | 3 |

# Attachment G

# Derivation of Critical Body Residues for Fish

**Attachment G Figure 1**
**Protocol for Selecting Critical Body Residues for Fish**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**




[1] Other acceptable effects levels, such as LC50s, may be presented if no acceptable NOEC or LOEC is identified.

LOEC - Lowest observed effect concentration.
NOEC - No observed effect concentration.

To identify the NOEC values for use in the ecological risk assessment (ERA), the lowest LOEC was first selected for the early life stage (ranging from egg to juvenile) and adult stage for each constituent. Once the LOECs were identified for the two life stages, the highest NOECs below the selected LOECs were identified as the NOEC values for use in the ERA.

**Attachment G Table 1**
**Critical Body Residues for Fish - Arsenic**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Adult*** | ***5.5*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Adult*** | ***5.5*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Adult*** | ***11.6*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Adult*** | ***11.6*** | ***Growth*** | ***LOEC*** | |
| Fish | x | x | | URS10 | Bluegill | Early life | 0.52 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | URS22 | Trout - Rainbow | Early life | 3 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | URS22 | Trout - Rainbow | Early life | 4.7 | Mortality | NA | |
| Fish | x | x | | NewFields11-072 | Trout - Rainbow | Early life | 15.4 | Mortality | LD88 | |
| Fish | x | x | | JA116 | Trout - Rainbow | Early life | 0.4 | Mortality | LD50 | |
| Fish | x | x | | JA116 | Trout - Rainbow | Early life | 2.6 | Mortality | LD50 | |
| Fish | x | x | | JA116 | Trout - Rainbow | Early life | 3 | Mortality | LD50 | |
| Fish | x | x | | JA116 | Trout - Rainbow | Early life | 4.7 | Mortality | LD50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Early life*** | ***1.8*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Early life*** | ***1.8*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Early life*** | ***2.24*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA149*** | ***Bluegill*** | ***Early life*** | ***2.24 - 11.7*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***0.5*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***0.85*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***1*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***1*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | | JA286 | Trout - Rainbow | Early life | 1.5 | Mortality | LD7 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***1.5*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***2*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | JA286 | Trout - Rainbow | Early life | 3 | Mortality | LC50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***3*** | ***Growth*** | ***LOEC*** | |
| Fish | x | x | | JA286 | Trout - Rainbow | Early life | 3.05 | Mortality | LD30 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***3.05*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***5.4*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***2 - 3.4*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA286*** | ***Trout - Rainbow*** | ***Early life*** | ***2 - 3.4*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | | JA287 | Trout - Rainbow | Early life | 8.1 | Mortality | LC50 | |
| Fish | x | x | | JA287 | Trout - Rainbow | Early life | 8.6 | Mortality | LC50 | |
| Fish | x | x | | JA287 | Trout - Rainbow | Early life | 13.5 | Mortality | LC50 | |
| Fish | x | x | | JA287 | Trout - Rainbow | Early life | 8.1 | Behavior | ED50 | |
| Fish | x | x | | JA287 | Trout - Rainbow | Early life | 8.6 | Behavior | ED50 | |
| Fish | x | x | | JA287 | Trout - Rainbow | Early life | 8.6 | Behavior | ED50 | |
| Fish | x | x | | JA287 | Trout - Rainbow | Early life | 13.5 | Behavior | ED50 | |
| Fish | x | x | | NewFields11-072 | Trout - Rainbow | Early life | 0.72 | Mortality | LD56 | |
| Fish | x | x | | NewFields11-072 | Trout - Rainbow | Early life | 1.1 | Mortality | LD06 | |
| Fish | x | x | | NewFields11-072 | Trout - Rainbow | Early life | 2.56 | Mortality | LD56 | |
| Fish | x | x | | JA416 | Green sunfish | Not reported | 116.3 | Physiological | NOEC | Lifestage not reported |
| Fish | x | x | | JA416 | Green sunfish | Not reported | 116.3 | Physiological | NOEC | Lifestage not reported |
| Fish | x | x | | JA416 | Green sunfish | Not reported | 0.002 | Mortality | LT50 | Lifestage not reported |
| Fish | x | x | | JA416 | Green sunfish | Not reported | 0.008 | Mortality | LT50 | Lifestage not reported |
| Fish | x | x | | JA416 | Green sunfish | Not reported | 6.7 | Mortality | LOEC | Lifestage not reported |
| Fish | x | x | | JA416 | Green sunfish | Not reported | 108 | Mortality | LOEC | Lifestage not reported |
| Fish | x | x | | JA416 | Green sunfish | Not reported | 116 | Mortality | LOEC | Lifestage not reported |
| Fish | x | x | | NewFields08-002 | Mummichog | Not reported | 5.99 | Mortality | LD20 | Lifestage not reported |
| Fish | x | x | | NewFields08-002 | Killifish | Not reported | 5.99 | Mortality | LD20 | Lifestage not reported |
| Fish | x | x | | NewFields08-002 | Mummichog | Not reported | 11.24 | Mortality | LD70 | Lifestage not reported |
| Fish | x | x | | NewFields08-002 | Killifish | Not reported | 11.24 | Mortality | LD70 | Lifestage not reported |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 29 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.06 | Growth | ED 21 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 12 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.006 | Growth | ED 8 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.78 | Growth | ED 11 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 16 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.06 | Growth | ED 11 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.78 | Growth | ED 19 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 9 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.78 | Growth | ED 16 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.06 | Growth | ED 21 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.06 | Growth | ED 21 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 12 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.006 | Growth | ED 8 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.78 | Growth | ED 11 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 29 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 16 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.78 | Growth | ED 19 | |

**Attachment G Table 1**
**Critical Body Residues for Fish - Arsenic**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 5.32 | Growth | ED 9 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.78 | Growth | ED 16 | |
| Fish | x | x | | Hansen23:1902-1911 | Oncorhynchus mykiss | Early life | 4.06 | Growth | ED 11 | |

**Notes:**
EDx - Effective dose to x% of the population
LCx - Concentration that is lethal to x% of population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
LTx - Lethal threshold to x% of population
NA - Not available
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the arsenic reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 1**
**Critical Body Residues for Fish - Arsenic (References)**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| NewFields11-072 | 2011 | Erickson RJ, DR Mount, TL Highland, JR Hockett, CT Jenson | Aquat Toxicol 104:108-115 |
| NewFields08-002 | 2007 | Shaw JR, B Jackson, K Gaber, S Stanton, JW Hamilton, BA Stanton | Environmental Toxicology and Chemistry 26(12):2704-2709 |
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| JA116 | 1981 | Dixion DG, JB Sprague | J Fish Biol 18:579-589 |
| JA149 | 1966 | Gilderhus, P.A. | Trans Am Fish Soc 095:289-296 |
| JA416 | 1976 | Sorensen EMB | Bull Environ Contam Toxicol 15:756-761 |
| URS22 | 1981 | Dixon, D.G. and J.B. Sprague | J. Fish Biol. 18: 579-589 |
| URS10 | 1980 | Barrows, M.E., S.R. Petrocelli, K.J. Macek and J.J. Carroll | p. 379-392 in Haque, R., ed. Dynamics, Exposure and Hazard Assessment of Toxic Chemicals |
| JA287 | 1992 | McGeachy SM, Dixon DG | Ecotoxicol Environ Saf 24:301–308 |
| Hansen23:1902-1911 | 2004 | Hansen et al | Environ Toxicol Chem 23:1902-1911 |

**Attachment G Table 2**
**Critical Body Residues for Fish - Cadmium**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | JA120 | Stone Loach | Not reported | 2.3 | Mortality | NOEC | No effect values in study; lifest |
| Fish | x | x | | JA126 | Perch | Early life | 0.075 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA135 | Belica | Not reported | 0.2 | Mortality | LD83 | Lifestage not reported |
| Fish | x | x | | JA135 | Fish | Not reported | 0.15 | Mortality | NOEC | No effect values in study; lifest |
| Fish | x | x | | JA163, 164 | Trout - Brook | Early life | 0.75 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA163, 164 | Trout - Brook | Early life | 0.14 | Mortality | LCx | |
| Fish | x | x | | JA163, 164 | Trout - Brook | Early life | 0.41 | Mortality | LCx | |
| Fish | x | x | | JA164 | Trout - Brook | Early life | 144 | Mortality | LD80 | |
| Fish | x | x | | JA164 | Trout - Brook | Early life | 282 | Mortality | LD59 | |
| Fish | x | x | | JA164 | Trout - Brook | Early life | 406 | Mortality | LD48 | |
| Fish | x | x | | JA164 | Trout - Brook | Early life | 751 | Mortality | LD42 | |
| Fish | x | x | | JA164 | Trout - Brook | Early life | 752 | Mortality | LD53 | |
| Fish | x | x | | JA181 | Guppy | Early life | 0.8-1.2 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA181 | Guppy | Early life | 0.8-1.2 | Mortality | LCx | |
| Fish | x | x | | JA181 | Guppy | Early life | 0.8 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA181 | Guppy | Early life | 8 | Mortality | LCx | |
| Fish | x | x | | JA181 | Guppy | Early life | 4.8 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA248 | Dace | Early life | 0.69 | Growth | NOEC | No effect values in study |
| Fish | x | x | x | JA248 | Trout - Rainbow | Early life | 0.47 | Growth | NOEC | |
| Fish | x | x | x | JA248 | Trout - Rainbow | Early life | 0.54 | Growth | NOEC | |
| Fish | x | x | x | JA248 | Trout - Rainbow | Early life | 0.96 | Growth | LOEC | |
| Fish | x | x | x | JA248 | Trout - Rainbow | Early life | 1.6 | Growth | LOEC | |
| Fish | x | x | | JA26 | Trout - Brook | Early life | 0.25 | Behavior | NOEC | No effect values in study |
| Fish | x | x | | JA26 | Trout - Brook | Early life | 0.026 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA26 | Trout - Brook | Early life | 0.042 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA26 | Trout - Brook | Early life | 0.04 | Mortality | NOEC | No effect values in study |
| Fish | x | x | x | JA26 | Trout - Brook | Early life | 0.13 | Growth | NOEC | |
| Fish | x | x | x | JA26 | Trout - Brook | Early life | 0.25 | Growth | LOEC | |
| Fish | x | x | | JA300 | Spot | Early life | 5.6 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA300 | Spot | Early life | 8.3 | Mortality | LC50 | |
| Fish | x | x | | JA300 | Spot | Early life | 9.9 | Mortality | LC50 | |
| Fish | x | x | | JA300 | Spot | Early life | 31 | Mortality | LC50 | |
| Fish | x | x | | JA300 | Spot | Early life | 43.2 | Mortality | LC50 | |
| Fish | x | x | | JA300 | Spot | Early life | 48 | Mortality | LC50 | |
| Fish | x | x | | JA300 | Spot | Early life | 59.4 | Mortality | LC50 | |
| Fish | x | x | | JA350 | Trout - Rainbow | Early life | 0.7 | Mortality | LCx | |
| Fish | x | x | | JA350 | Trout - Rainbow | Early life | 1 | Mortality | LCx | |
| Fish | x | x | x | JA350 | Trout - Rainbow | Early life | 9.1 | Mortality | LOEC | |
| Fish | x | x | x | JA350 | Trout - Rainbow | Early life | 9.7 | Mortality | LOEC | |
| Fish | x | x | | JA351 | Stickleback | Early life | 0.9 | Mortality | LCx | |
| Fish | x | x | x | JA379 | Atlantic salmon | Early life | 0.06 | Growth | NOEC | |
| Fish | x | x | x | JA379 | Atlantic salmon | Early life | 0.12 | Growth | LOEC | |
| Fish | x | x | x | JA379 | Atlantic salmon | Early life | 0.25 | Mortality | NOEC | |
| Fish | x | x | x | JA379 | Atlantic salmon | Early life | 0.56 | Mortality | LOEC | |
| Fish | x | x | x | JA379 | Atlantic salmon | Early life | 2 | Mortality | NOEC | |
| Fish | x | x | x | JA379 | Atlantic salmon | Early life | 4 | Mortality | LOEC | |
| Fish | x | x | | JA380 | Atlantic salmon | Early life | 0.3 | Growth | NOEC | No effect values in study |
| Fish | x | x | x | JA381 | Atlantic salmon | Early life | 0.4 | Growth | LOEC | |
| Fish | x | x | | JA405 | Seabass; Barramundi; Giant Perch | Early life | 2.5 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA405 | Seabass; Barramundi; Giant Perch | Early life | 20.38 | Mortality | LD50 | |
| Fish | x | x | | JA405 | Seabass; Barramundi; Giant Perch | Early life | 30.48 | Mortality | LD50 | |
| Fish | x | x | x | JA418 | Flagfish | Early life | 2 - 8 | Growth | NOEC | |
| Fish | x | x | x | JA418 | Flagfish | Early life | 1.2 - 5 | Reproduction | NOEC | |
| Fish | x | x | x | JA418 | Flagfish | Early life | 2 - 8 | Reproduction | LOEC | |
| Fish | x | x | x | JA418 | Flagfish | Early life | 4 - 15.6 | Growth | LOEC | |
| Fish | x | x | x | JA420 | Flagfish | Early life | 6 | Mortality | LOEC | |
| Fish | x | x | | JA482 | European Flounder | Early life | 14 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA482 | European Flounder | Early life | 20 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA482 | European Flounder | Early life | 21 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA482 | European Flounder | Early life | 36 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA491 | Stickleback | Early life | 0.11 | Mortality | NOEC | Injection-based study |
| Fish | x | x | | JA491 | Stickleback | Early life | 0.3 | Mortality | LCx | |
| Fish | x | x | | JA491 | Stickleback | Early life | 0.75 | Mortality | LCx | |
| Fish | x | x | | JA491 | Stickleback | Early life | 2.94 | Mortality | LCx | |
| Fish | x | x | | JA491 | Three-spined Stickleback | Not reported | 0.3 | Mortality | LD6 | Lifestage not reported |
| Fish | x | x | | JA491 | Three-spined Stickleback | Not reported | 0.75 | Mortality | LD10 | Lifestage not reported |
| Fish | x | x | | JA491 | Three-spined Stickleback | Not reported | 2.94 | Mortality | LD27 | Lifestage not reported |
| Fish | x | x | x | JA81 | Bluegill | Early life | 0.036 | Mortality | NOEC | |
| Fish | x | x | x | JA81 | Bluegill | Early life | 0.35 | Mortality | LOEC | |
| Fish | x | x | | JA92 | Bluegill | Early life | 1.33 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA92 | Bluegill | Early life | 0.52 | Mortality | NOEC | No effect values in study |
| Fish | x | x | x | JB9 | Trout - Brook | Early life | 144 | Mortality | LOEC | |
| Fish | x | x | | MEC03-042 | Trout - Rainbow | Early life | 0.9 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | MEC03-052 | Trout - Bull | Early life | 0.114 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | MEC03-052 | Trout - Bull | Early life | 0.183 | Mortality | LD36 | |
| Fish | x | x | | MEC03-199 | Striped mullet | Early life | 1.06 | Mortality | LD26 | |
| Fish | x | x | | MEC03-199 | Striped mullet | Early life | 1.77 | Mortality | LD37 | |
| Fish | x | x | | MEC03-199 | Striped mullet | Early life | 5.28 | Mortality | LD100 | |
| Fish | x | x | | MEC03-199 | Striped mullet | Early life | 26.3 | Mortality | LD81 | |
| Fish | x | x | | NewFields07-006 | Melita plumulosa | Early life | 15.4 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 1 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 2 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 3 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 8 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 10 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 24 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 25 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 26 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 29 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 31 | Mortality | LD100 | |
| Fish | x | x | | NewFields07-014 | Gudgeon | Adult | 32 | Mortality | LD100 | |
| Fish | x | x | | NewFields11-044 | Synechogobius hasta | Early life | 0.014 | Mortality | LD17 | |
| Fish | x | x | | NewFields11-044 | Synechogobius hasta | Early life | 0.018 | Mortality | LD27 | |
| Fish | x | x | | NewFields11-044 | Synechogobius hasta | Early life | 0.026 | Mortality | LD35 | |
| Fish | x | x | | SEQ97-33 | American flagfish | Early life | 35 | Mortality | NOEC | No effect values in study |
| Fish | x | x | x | SEQ97-34 | American flagfish | Early life | 0.09 | Mortality | NOEC | |
| Fish | x | x | x | SEQ97-34 | American flagfish | Early life | 0.4 | Mortality | LOEC | |
| Fish | x | x | | SEQ97-6 | Trout - Rainbow | Adult | 2.2 | Mortality | ED50 | |
| Fish | x | x | | SEQ97-6 | Trout - Rainbow | Adult | 3.74 | Mortality | ED50 | |

**Attachment G Table 2**
**Critical Body Residues for Fish - Cadmium**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | SEQ97-6 | Trout - Rainbow | Adult | 4 | Mortality | ED50 | |
| Fish | x | x | | SEQ97-6 | Trout - Rainbow | Adult | 6.4 | Mortality | ED50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ99J-04*** | ***Three-spined Stickleback*** | ***Adult*** | ***0.9*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS107*** | ***Guppy*** | ***Early life*** | ***1*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS107*** | ***Guppy*** | ***Early life*** | ***1.2*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | URS107 | Guppy | Early life | 5 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | URS107 | Guppy | Early life | 8 | Mortality | LD50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS13*** | ***Trout - Rainbow*** | ***Early life*** | ***0.21*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | URS13 | Trout - Rainbow | Early life | 101 | Mortality | LD100 | |
| Fish | x | x | | URS13 | Trout - Rainbow | Early life | 0.84 | Mortality | LD100 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS13*** | ***Trout - Rainbow*** | ***Early life*** | ***0.71*** | ***Behavior*** | ***LOEC*** | |
| Fish | x | x | | URS99 | Trout - Rainbow | Adult | 0.25 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000005 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000007 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000015 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000018 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.00003 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000038 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000065 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.00008 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.0001 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.00015 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.0002 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000275 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.0003 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.000325 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.00045 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston06-024 | Trout - Rainbow | Early life | 0.0005 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS198*** | ***Sheepshead minnow*** | ***Early life*** | ***0.5*** | ***Development*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS198*** | ***Sheepshead minnow*** | ***Early life*** | ***2*** | ***Development*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-070*** | ***Trout - Rainbow*** | ***Early life*** | ***0.71*** | ***Behavior*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-070*** | ***Trout - Rainbow*** | ***Early life*** | ***0.21*** | ***Behavior*** | ***LOEC*** | |

**Notes:**
EDx - Effective dose to x% of the population
LCx - Concentration that is lethal to x% of population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the cadmium reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 2**
**Critical Body Residues for Fish - Cadmium (References)**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| JA120 | 1989 | Douben PET | Arch Environ Contam Toxicol 18:579-586 |
| JA135 | 1983 | Ferard JF, JM Jouany, R Truhaut, P Vasseur | Ecotoxicol Environ Saf 07:43-52 |
| JA164 | 1987 | Hamilton, SJ, PM Mehrle, and JR Jones | Trans Am Fish Soc 116:551-560 |
| NewFields07-006 | 2006 | Gale SA, CK King, RV Hyne | Environmental Toxicology and Chemistry 25:1887-1898 |
| JA26 | 1976 | Benoit, D.A., E.N. Leonard, G.M. Christensen, and J.T. Fiandt | Trans Am Fish Soc 004, pp. 550-560 |
| JA300 | 1975 | Middaugh, DP, WR Davis, RL Yoakum | Cont Mar Sci 19:13-19 |
| JA405 | 1995 | Shazili NAM | Bull Environ Contam Toxicol 54:22-28 |
| JA482 | 1995 | Westerhagen HV, V Dethlefsen | J Mar Biol Ass UK 55:945-975 |
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| SEQ99J_04 | 1977 | Pascoe, D., and F.L. Mattey | J. Fish. Biol. 11, 207-215 |
| URS107 | 1982 | Hatakeyama, S. and M. Yasuno | Bull Environ Contam Toxicol 29:159-166 |
| URS13 | 1978 | Beattie, J.H. and D. Pascoe | J. Fish. Biol. 13:631-637. |
| URS99 | 1992 | Handy, R.D. | Arch Environ Contam Toxicol 22:74-81 |
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| MEC03-052 | 2002 | Hansen, J.A., P.G. Welsh, J. Lipton, M.J. Suedkamp | Aquat Toxicol 58:165-174 |
| MEC03-199 | 2000 | Zyadah, MA, E Abdel-Baky | Bull Environ Contam Toxicol 64:740-747 |
| Weston06-024 | 2005 | Franklin NM, CN Glover, JA Nicol, CM Wood | Environ Tox & Chem 24:2954-2964 |
| NewFields07-014 | 2004 | Knapen D, L Bervoets, E Verheyen, R Blust | Aquatic Toxicol 67:155-165 |
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| JA248 | 1973 | Kumada H, Kimura S, Yokote M, Matida Y | Bull Freshwater Fish Res Lab (Tokyo) 22:157–165 |
| JA379 | 1982 | Rombough PJ, Garside ET | Can J Zool 60:2006–2014 |
| JA81 | 1974 | Cearley JE, Coleman RL | Bull Environ Contam Toxicol 11:146–151 |
| JA126 | 1980 | Edgren M, Notter M | Bull Environ Contam Toxicol 24:647–651 |
| JA350 | 1986 | Pascoe D, Evans SA, Woodworth J | Arch Environ Contam Toxicol 15:481–487 |
| JA181 | 1982 | Hatakeyama S, Yasuno M | Bull Environ Contam Toxicol 29:159–166 |
| JA351 | 1977 | Pascoe D, Mattey DL | J Fish Biol 11:207–215 |
| JA420 | 1978 | Spehar RL, Leonard EN, DeFoe DL | Trans Am Fish Soc 107:354–360 |
| JA418 | 1976 | Spehar RL | J Fish Res Board Can 33:1939–1945 |
| JA163 | 1987 | Hamilton SJ, Mehrle PM, Jones JR | Trans Am Fish Soc 116:541–550 |
| JA380 | 1986 | Rossaro B, Gaggino GF, Marchetti R | Bull Environ Contam Toxicol37:402–406 |
| JA381 | 1983 | Rubinstein NI, Lores E, Gregory NR | Aquat Toxicol 3:249–260 |
| URS198 | 1988 | Meteyer, MJ, Wright, DA, Martin, FD | Environ Tox & Chem 07:321-328 |
| MEC04-070 | 1984 | Dillon, TM | Army Corps of Engineers Report Technical Report, D-84-2 |

**Attachment G Table 3**
**Critical Body Residues for Fish - Copper**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-033*** | ***Trout - Rainbow*** | ***Early life*** | ***2.6*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***ABB2*** | ***Trout - Rainbow*** | ***Early life*** | ***4.5*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA432*** | ***Common carp*** | ***Early life*** | ***5.08*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA432*** | ***Common carp*** | ***Early life*** | ***8.9*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA432*** | ***Common carp*** | ***Early life*** | ***11.4*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA432*** | ***Common carp*** | ***Early life*** | ***20.3*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA432 | Common carp | Early life | 101.7 | Mortality | LD81 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA432*** | ***Common carp*** | ***Early life*** | ***11.7*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC03-058*** | ***Common carp*** | ***Early life*** | ***11.7*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | MEC03-199 | Striped mullet | Early life | 1.5 | Mortality | LD10 | |
| Fish | x | x | | MEC03-199 | Striped mullet | Early life | 7.5 | Mortality | LD100 | |
| Fish | x | x | | MEC03-289 | Trout - Rainbow | Early life | 1.72 | Growth | NOEC | No effect values in study |
| Fish | x | x | | MEC03-289 | Trout - Rainbow | Early life | 1.72 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | MEC03-289 | Trout - Rainbow | Early life | 5.24 | Growth | NOEC | No effect values in study |
| Fish | x | x | | MEC03-289 | Trout - Rainbow | Early life | 5.24 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC03-338*** | ***Trout - Bull*** | ***Early life*** | ***7.6*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | MEC03-338 | Trout - Bull | Early life | 19.79 | Growth | NOEC | No effect values in study |
| Fish | x | x | | MEC03-338 | Trout - Bull | Early life | 19.79 | Mortality | LD05 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC03-338*** | ***Trout - Bull*** | ***Early life*** | ***19.79*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-033*** | ***Trout - Rainbow*** | ***Early life*** | ***1.68*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-033*** | ***Trout - Rainbow*** | ***Early life*** | ***1.96*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-033*** | ***Trout - Rainbow*** | ***Early life*** | ***2*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | MEC04-033 | Trout - Rainbow | Early life | 2 | Growth | ED19 | |
| Fish | x | x | | MEC04-033 | Trout - Rainbow | Early life | 2.6 | Growth | ED33 | |
| Fish | x | x | | MEC04-033 | Trout - Rainbow | Early life | 3.22 | Mortality | LD45 | |
| Fish | x | x | | MEC04-033 | Trout - Rainbow | Early life | 3.22 | Growth | ED48 | |
| Fish | x | x | | NewFields10-026 | Salmon-coho | Early life | 16 | Mortality | LC88 | |
| Fish | x | x | | NewFields10-026 | Salmon-coho | Early life | 17.6 | Mortality | LC46 | |
| Fish | x | x | | NewFields10-047 | Sharptooth Catfish | Early life | 16.27 | Growth | NOEC | No effect values in study |
| Fish | x | x | | NewFields10-047 | Sharptooth Catfish | Early life | 16.27 | Growth | NOEC | No effect values in study |
| Fish | x | x | | NewFields11-043 | Synechogobius hasta | Early life | 0.226 | Growth | ED38 | |
| Fish | x | x | | NewFields11-043 | Synechogobius hasta | Early life | 0.226 | Growth | ED33 | |
| Fish | x | x | | NewFields11-043 | Synechogobius hasta | Early life | 0.226 | Mortality | LD29 | |
| Fish | x | x | | NewFields11-043 | Synechogobius hasta | Early life | 0.274 | Growth | ED61 | |
| Fish | x | x | | NewFields11-043 | Synechogobius hasta | Early life | 0.274 | Growth | ED59 | |
| Fish | x | x | | NewFields11-043 | Synechogobius hasta | Early life | 0.274 | Mortality | LD36 | |
| Fish | x | x | | NewFields11-079 | Mosquito fish | Early life | 1.14 | Mortality | LD46 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-079*** | ***Mosquito fish*** | ***Early life*** | ***1.5*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | NewFields11-079 | Mosquito fish | Early life | 5.69 | Growth | ED133 | |
| Fish | x | x | | NewFields11-079 | Mosquito fish | Early life | 5.69 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-079*** | ***Mosquito fish*** | ***Early life*** | ***7.53*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | | NewFields11-079 | Mosquito fish | Early life | 7.53 | Reproduction | NOEC | No effect values in study |
| Fish | x | x | | SEQ99_10 | Trout - Rainbow | Early life | 18.1 | Growth | ED25 | |
| Fish | x | x | | SEQ99_10 | Trout - Rainbow | Early life | 18.1 | Growth | ED45 | |
| Fish | x | x | | SEQ99_10 | Trout - Rainbow | Early life | 20.5 | Growth | ED25 | |
| Fish | x | x | | SEQ99_10 | Trout - Rainbow | Early life | 20.6 | Growth | ED10 | |
| Fish | x | x | | SEQ99_10 | Trout - Rainbow | Early life | 20.9 | Growth | ED25 | |
| Fish | x | x | | SEQ99_10 | Trout - Rainbow | Early life | 25.9 | Growth | ED50 | |
| Fish | x | x | | URS23 | Trout - Rainbow | Early life | 1.6 | Mortality | LD100 | |
| Fish | x | x | | URS23 | Trout - Rainbow | Early life | 7 | Mortality | NA | |
| Fish | x | x | | URS99 | Trout - Rainbow | Early life | 2.22 | Mortality | LD50 | |
| Fish | x | x | | Weston05-005 | Trout - Rainbow | Early life | 1.4 | Mortality | LD11 | |
| Fish | x | x | | Weston05-005 | Trout - Rainbow | Early life | 1.4 | Growth | ED35 | |
| Fish | x | x | | Weston05-005 | Trout - Rainbow | Early life | 1.7 | Mortality | LD26 | |
| Fish | x | x | | Weston05-005 | Trout - Rainbow | Early life | 1.7 | Growth | ED56 | |
| Fish | x | x | | Weston06-009 | Salmon - Atlantic | Early life | 1.7 | Growth | ED17 | |
| Fish | x | x | | Weston06-009 | Salmon - Atlantic | Early life | 1.7 | Growth | ED61 | |
| Fish | x | x | | Weston06-009 | Salmon - Atlantic | Early life | 1.7 | Growth | ED41 | |
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 3.44 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 2.36 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 4.36 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 5.62 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 3.44 | Growth | NOEC | No effect values in study |
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 2.36 | Growth | NOEC | No effect values in study |

**Attachment G Table 3**
**Critical Body Residues for Fish - Copper**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 4.36 | Growth | NOEC | No effect values in study |
| Fish | x | x | | ERED-01 | Terapon jarbua | Early life | 5.62 | Growth | NOEC | No effect values in study |

**Notes:**
EDx - Effective dose to x% of the population
LCx - Concentration that is lethal to x% of population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NA - Not available
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the copper reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 3**
**Critical Body Residues for Fish - Copper (References)**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| MEC04-033 | 2002 | Hansen, JA, J Lipton, PG Welsh, J Morris, D Cacela, MJ Suedkamp | Aquat Toxicol 58:175-188 |
| ABB2 | 1994 | Mount, D.R., A.K. Barth, T.D.Garrison, K.A. Barten, and J.R. Hockett | Environ Tox & Chem 13(12):2031-2041 |
| JA432 | 1996 | Stouthart XJHX, JLM Haans, RAC Lock, SE Wendelaar Bonga | Environ Tox & Chem 15:376-383 |
| SEQ99_10 | 1996 | Marr, J.C.A., J. Lipton, D. Cacela, J. A. Hansen, H. L. Bergman, J.S. Meyer, and C. Hogstrand | Aquat Toxicol |
| URS23 | 1981 | Dixon, D.G. and J.B. Sprague | Aquat Toxicol 01:69-81. |
| URS99 | 1992 | Handy, R.D. | Arch Environ Contam Toxicol 22:74-81 |
| MEC03-058 | 2002 | Flik, G., X.J.H.X. Stouthart, F.A.T. Spanings, R.A.C. Lock, J.C. Fenwick, S.E.W. Bonga | Aquat Toxicol 56:167-176 |
| MEC03-199 | 2000 | Zyadah, MA, E Abdel-Baky | Bull Environ Contam Toxicol 64:740-747 |
| MEC03-289 | 2001 | Kamunda CN, M Grosell, JNA Lott, and CM Wood | Can J Fish Aquat Sci 58:293-305 |
| MEC03-338 | 2002 | Hansen J.A., P.G. Welsh, J. Lipton, D. Cacela | Trans Am Fish Soc 131:690-697 |
| Weston05-005 | 2005 | Kamunde CN, S Niyogi, CM Wood | Can J Fish Aquat Sci 62:390-399 |
| Weston06-009 | 2005 | Dube MG, LD MacLatchy, JD Kieffer, NE Glozier, JM Culp, KJ Cash | Sci Total Environ 343:135-154 |
| NewFields10-026 | 1993 | Borgmann, U, WP Norwood, and C Clarke | Hydrobiologia 259:78-89. |
| NewFields10-047 | 2007 | Hoyle I, BJ Shaw, RD Handy | Aquat Toxicol 83:62-72 |
| NewFields11-043 | 2010 | Liu XJ, Z Luo, BX Xiong, X Liu, YH Zhao, GF Hu, GJ Lv | Ecotox & Environ Saf 731286-1291 |
| NewFields11-079 | 2011 | Hoang TC, RL Pryor, GM Rand, and RA Frakes | Ecotox & Environ Saf 74:1011-1020 |
| ERED-01 | 2005 | Long A and W Wang | Mar Ecol Prog Ser 291:215-226 |

**Attachment G Table 4**
**Critical Body Residues for Fish - Lead**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA207*** | ***Trout - Brook*** | ***Adult*** | ***0.34*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA207*** | ***Trout - Brook*** | ***Adult*** | ***0.4*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA207 | Trout - Brook | Early life | 4.02 | Growth | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA207*** | ***Trout - Brook*** | ***Adult*** | ***2.5 - 5.1*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA207*** | ***Trout - Brook*** | ***Adult*** | ***4.0 - 8.8*** | ***Growth*** | ***LOEC*** | |
| Fish | x | x | | NewFields10-026 | Salmon-coho | Early life | 3.2 | Mortality | LC27 | |
| Fish | x | x | | NewFields10-026 | Salmon-coho | Early life | 3.8 | Mortality | LC53 | |
| Fish | x | x | | NewFields10-026 | Salmon-coho | Early life | 4.2 | Mortality | LC94 | |
| Fish | x | x | | NewFields10-026 | Salmon-coho | Early life | 6.0 | Mortality | LC82 | |
| Fish | x | | | URS124 | Trout - Brook | Early life | 2.54 | Morphology | NOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS124*** | ***Trout - Brook*** | ***Early life*** | ***2.6*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS124*** | ***Trout - Brook*** | ***Early life*** | ***4*** | ***Growth*** | ***LOEC*** | |
| Fish | x | | | URS124 | Trout - Brook | Early life | 4.02 | Morphology | LOEC | |
| Fish | x | x | | URS124 | Trout - Brook | Early life | 4.02 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS230*** | ***Fathead minnow*** | ***Early life*** | ***26.2*** | ***Behavior*** | ***LOEC*** | |
| Fish | x | | | URS230 | Fathead minnow | Early life | 26.2 | Biochemical | NOEC | |
| Fish | x | | | URS230 | Fathead minnow | Early life | 44.2 | Biochemical | LOEC | |
| Fish | x | | | URS230 | Fathead minnow | Early life | 44.2 | Biochemical | NOEC | |
| Fish | x | x | | Weston05-031 | Trout - Rainbow | Early life | 0.278 | Growth | ED19 | |
| Fish | x | x | | Weston05-031 | Trout - Rainbow | Early life | 0.278 | Growth | ED16 | |
| Fish | x | x | | Weston05-031 | Trout - Rainbow | Early life | 0.278 | Growth | ED11 | |
| Fish | x | x | | Weston05-031 | Trout - Rainbow | Early life | 0.278 | Growth | ED30 | |

**Notes:**
EDx - Effective dose to x% of the population
LCx - Concentration that is lethal to x% of population
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the lead reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 4**
**Critical Body Residues for Fish - Lead (References)**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| Weston05-031 | 2004 | Hansen JA; J Lipton; PG Welsh; D Cacela; B MacConnell | Environ Tox & Chem 23:1902-1911 |
| JA207 | 1976 | Holcombe GW, DA Benoit, EN Leonard, JM McKim | J Fish Res Board Can 33:1731-1741 |
| URS124 | 1976 | Holcombe, G.W., D.A. Benoit, E.N. Leonard and J.M. Mckim | J Fish Res Bd Can 33:1731-1741. |
| URS230 | 1991 | Weber, D.N., Russo, A., Seale, D.B., Spieler, R.E. | Aquat Toxicol 21: 71-80 |
| NewFields10-026 | 1993 | Borgmann, U, WP Norwood, and C Clarke | Hydrobiologia 259:78-89. |

## Attachment G Table 5
## Critical Body Residues for Fish - Mercury

| Receptor Group | Included species | Included Effect | Included Endpoint | Reference Identification | Lifestage | Species (Common name) | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | URS113 | Early life | Trout - rainbow | 1.02 | Mortality | LD50 | |
| Fish | x | x | | JA189 | Adult | Goldfish | 7 | Mortality | LD100 | |
| Fish | x | x | | JA189 | Adult | Goldfish | 5.6 | Mortality | LD80 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA189*** | ***Adult*** | ***Goldfish*** | ***6.2*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | JA246 | Adult | Guppy | 0.2 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA301 | Not reported | Trout - rainbow | 11.9 | Mortality | LD50 | Lifestage not reported |
| Fish | x | x | | JA301 | Not reported | Northern Pike | 15 | Mortality | LD50 | Lifestage not reported |
| Fish | x | | | JA327 | Not reported | Trout - rainbow | 12 | Physiological | NOEC | Lifestage not reported |
| Fish | x | | | JA327 | Not reported | Trout - rainbow | 12 | Physiological | NOEC | Lifestage not reported |
| Fish | x | x | | JA327 | Not reported | Trout - rainbow | 12 | Mortality | NOEC | No effect values in study; lifestage not reported |
| Fish | x | x | | JA33 | Early life | Trout - rainbow | 90.2 | Mortality | LD100 | |
| Fish | x | x | | JA33 | Early life | Channel Catfish | 0.06 | Mortality | LD50 | |
| Fish | x | x | | JA33 | Early life | Trout - rainbow | 26.9 | Mortality | LD76 | |
| Fish | x | x | | JA331 | Not reported | European eel | 15.3 | Mortality | LD25 | Lifestage not reported |
| Fish | x | x | | JA331 | Not reported | European eel | 0.56 | Mortality | NOEC | Lifestage not reported |
| Fish | x | x | | JA341 | Early life | Fathead minnow | 10.69 | Behavior | NOEC | No effect values in study |
| Fish | x | x | | JA341 | Early life | Fathead minnow | 10.69 | Growth | NOEC | No effect values in study |
| Fish | x | | | JA341 | Early life | Fathead minnow | 10.69 | Morphology | NOEC | |
| Fish | x | x | | JA341 | Early life | Fathead minnow | 10.69 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA361 | Early life | Trout - rainbow | 0.99 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA361 | Early life | Trout - rainbow | 2.28 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA361 | Early life | Trout - rainbow | 2.96 | Growth | NOEC | No effect values in study |
| Fish | x | | | JA489 | Early life | Trout - rainbow | 10 | Cellular | LOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA489*** | ***Early life*** | ***Trout - rainbow*** | ***10*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | | | MEC03-219 | Adult | Largemouth Bass | 5.4 | Physiological | NOEC | |
| Fish | x | | | MEC03-219 | Adult | Largemouth Bass | 5.4 | Physiological | ED30 | |
| Fish | x | | | MEC03-219 | Adult | Largemouth Bass | 1.23 | Physiological | IP-100 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-120*** | ***Early life*** | ***Grayling*** | ***3.8*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | | | MEC04-120 | Early life | Grayling | 3.8 | Morphology | LOEC | |
| Fish | x | x | | MEC04-120 | Early life | Grayling | 3.8 | Mortality | LD53 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-120*** | ***Early life*** | ***Grayling*** | ***0.27*** | ***Behavior*** | ***LOEC*** | |
| Fish | x | x | | MEC04-120 | Early life | Grayling | 3.8 | Growth | NOEC | No effect values in study |
| Fish | x | x | | NewFields10-026 | Early life | Salmon - coho | 18 | Mortality | LC72 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***Green sturgeon*** | ***4.8*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***Green sturgeon*** | ***8.6*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***Green sturgeon*** | ***10.8*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 21.8 | Mortality | LD08 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 8.6 | Growth | ED10 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 21.8 | Growth | ED47 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 4.8 | Growth | ED13 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 8.6 | Growth | ED13 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 21.8 | Growth | ED16 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***Green sturgeon*** | ***5*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 15.2 | Mortality | LD64 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 5 | Growth | ED15 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 15.2 | Growth | ED60 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 5 | Growth | ED17 | |
| Fish | x | x | | NewFields11-075 | Early life | Green sturgeon | 15.2 | Growth | ED117 | |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 4 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 10 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 20 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***White sturgeon*** | ***4*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 20 | Growth | ED18 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***White sturgeon*** | ***10*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 20 | Growth | ED108 | |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 6.8 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 10 | Growth | ED10 | |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 12.6 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 6.8 | Growth | ED121 | |
| Fish | x | x | | NewFields11-075 | Early life | White sturgeon | 12.6 | Growth | ED11 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***White sturgeon*** | ***6.8*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields11-075*** | ***Early life*** | ***White sturgeon*** | ***12.6*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***1.31*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***1.36*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***4.76*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***18.8*** | ***Growth*** | ***LOEC*** | |
| Fish | x | | | SEQ97-31 | Adult | Fathead minnow | 4.18 | Morphology | LOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***4.18*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***0.32*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***0.8*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***2.64*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***9.41*** | ***Growth*** | ***NOEC*** | |
| Fish | x | | | SEQ97-31 | Adult | Fathead minnow | 2.75 | Morphology | NOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***2.75*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***7.6*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | URS113 | Early life | Trout - rainbow | 15 | Mortality | LD100 | Injection-based study |
| Fish | x | x | | URS113 | Early life | Trout - rainbow | 5.1 | Mortality | LD50 | Injection-based study |
| Fish | x | x | | URS113 | Early life | Trout - rainbow | 2 | Mortality | LOEC | Injection-based study |
| Fish | x | | | URS166 | Adult | Northern Pike | 7 | Biochemical | LOEC | |
| Fish | x | | | URS166 | Adult | Northern Pike | 7 | Morphology | LOEC | |
| Fish | x | | | URS166 | Adult | Northern Pike | 7 | Physiological | LOEC | |
| Fish | x | | | URS166 | Adult | Northern Pike | 7 | Cellular | NOEC | |
| Fish | x | x | | URS180 | Adult | Winter Flounder | 5 | Mortality | LD50 | |
| Fish | x | | | URS180 | Adult | Winter Flounder | 2 | Biochemical | LOEC | |
| Fish | x | | | URS21 | Early life | Walleye | 0.25 | Biochemical | LOEC | |
| Fish | x | | | URS21 | Early life | Walleye | 0.25 | Cellular | LOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS21*** | ***Early life*** | ***Walleye*** | ***0.25 (a)*** | ***Development*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS21*** | ***Early life*** | ***Walleye*** | ***2.37*** | ***Growth*** | ***LOEC*** | |
| Fish | x | | | URS21 | Early life | Walleye | 2.37 | Cellular | NOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS21*** | ***Early life*** | ***Walleye*** | ***2.37*** | ***Development*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS21*** | ***Early life*** | ***Walleye*** | ***0.25*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | | URS21 | Early life | Walleye | 2.37 | Mortality | NOEC | No effect values in study |

**Attachment G Table 5**
**Critical Body Residues for Fish - Mercury**

| Receptor Group | Included species | Included Effect | Included Endpoint | Reference Identification | Lifestage | Species (Common name) | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | URS232 | Adult | Yellow perch | 0.135 | Growth | NOEC | No effect values in study |
| Fish | x | x | | URS33 | Early life | Trout - rainbow | 0.14 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | URS33 | Early life | Trout - rainbow | 0.47 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | URS95 | Not reported | Spiny Dogfish | 0.093 | Behavior | NOEC | Lifestage not reported; injection-based study |
| Fish | x | x | | URS95 | Not reported | Spiny Dogfish | 0.093 | Mortality | NOEC | No effect values in study; lifestage not reported |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA33*** | ***Early life*** | ***Trout - rainbow*** | ***96.8*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA33*** | ***Early life*** | ***Trout - rainbow*** | ***0.9*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA33 | Early life | Trout - rainbow | 0.27 | Mortality | LCx | |
| Fish | x | x | | JA33 | Early life | Trout - rainbow | 0.04 | Mortality | LCx | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA189*** | ***Adult*** | ***Goldfish*** | ***>7*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA189 | Adult | Goldfish | 5.6 | Mortality | LCx | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA189*** | ***Adult*** | ***Goldfish*** | ***6.1*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***2.75*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | SEQ97-31 | Adult | Fathead minnow | 7.6 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | SEQ97-31 | Adult | Fathead minnow | 4.47 | Reproduction | LCx | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-31*** | ***Adult*** | ***Fathead minnow*** | ***2.84*** | ***Reproduction*** | ***NOEC*** | |
| Fish | x | x | | JA33 | Early life | Channel catfish | 0.34 | Mortality | LCx | |
| Fish | x | x | | JA188 | Early life | Japanese medaka | 29 - 56 | Mortality | LCx | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA188*** | ***Early life*** | ***Japanese medaka*** | ***16*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | JA246 | Adult | Guppy | 0.2 | Mortality | NOEC | No effect values in study |

**Notes:**
EDx - Effective dose to x% of the population
IPx - Inhibition of proliferation of cells to x% of population
LCx - Concentration that is lethal to x% of population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration
(a) Following a review of the study, the control group body burden (0.06 mg/kg) following a six month exposure period was selected as the NOEC for this endpoint.

The Reference Identification corresponds to references presented in the mercury reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 5**
**Critical Body Residues for Fish - Mercury (References)**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| JA188 | 1975 | Heisinger JF, Green W. | Bull Environ Contam Toxicol14:665–673. |
| JA189 | 1979 | Heisinger, J.F., C.D. Hansen, and J.H. Kim. | Arch Environ Contam Toxicol 08:279-283 |
| JA246 | 1979 | Kudo, A. and D.C. Mortimer. | Environ Pollut 019:239-245. |
| JA301 | 1970 | Mieltinen, E Blankenstein, K Rissanen, M Valtonen | FAO Tech Conference 99:171-172 |
| JA327 | 1984 | Niimi AJ, L Lowe-Jinde | Arch Environ Contam Toxicol 13:303-311 |
| JA33 | 1979 | Birge WJ, JA Black, AG Westerman, JE Hudson | The Biogeochemistry of Mercury, pg 629-655 |
| JA331 | 1977 | Noel-Lambot, F. and J.M. Bouquegneau. | Bull Environ Contam Toxicol 18(4):418-424 |
| JA341 | 1975 | Olson GF, DJ Mount, VM Snarski, TW Thorslund | Bull Environ Contam Toxicol 14:129-134 |
| JA361 | 1978 | Phillips GR, DR Buhler | Trans Am Fish Soc 107-853-861 |
| JA489 | 1975 | Wobeser, G. | J Fish Res Bd Can 32(11), 2015-2023. |
| MEC03-219 | 2002 | Friedmann, A., E. Costain, D. MacLatchy, W. Stansley and E. Washuta | Ecotoxicol Environ Saf 52:117-122 |
| MEC04-120 | 1998 | Vollestad LA, E Fjeld, T Haugen, SA Oxnevad | Environ Pollut 101:349-354 |
| NewFields10-026 | 1993 | Borgmann, U, WP Norwood, and C Clarke | Hydrobiologia 259:78-89. |
| NewFields11-075 | 2011 | Lee J-W, N De Riu, S Lee, SC Bai, G Moniello, SSO Hung | Aquat Toxicol In press (on-line) |
| SEQ97-31 | 1982 | Snarski, V.M., Olson, G.F. | Aquat Toxicol 2:143-156 |
| URS113 | 1979 | Hawryshyn, C.W. and W.C. Mackay | Bull Environ Contam Toxicol 23:79-86 |
| URS166 | 1972 | Lockhart, W.L., J.F. Uthe, A.R. Kenney and P.M. Mehrle | J Fish Res Bd Can 29:1519-1523. |
| URS180 | 1976 | Manen, C.A., B. Schmidt-nielsen and D.N. Russell | Amer. J. Physiol. 231:560-564. |
| URS21 | 1996 | Friedmann, A.S., M.C. Watzin, T. Brinck-Johnsen and J.C. Leiter | Aquat Toxicol 35:265-278 |
| URS232 | 1990 | Wiener, J.G., Fitzgerald, W.F., Watras, C.J., Rada, R.G. | Environ Tox & Chem 09:909-918 |
| URS33 | 1985 | Boudou, A. and F. Ribeyre | Water Air Soil Pollut. 26:137-148. |
| URS95 | 1979 | Guarino, A.M. and S.T. Arnold | p. 233-258 in Khan, et.al. Pesticide and Xenobiotic Metabolism in Aquatic Organisms |

**Attachment G Table 6**
**Critical Body Residues for Fish - Nickel**

| Receptor Group | Included species | Included Effect | Included Endpoint | Reference Identification | Lifestage | Species (Common name) | Concentration (mg/kg wet weight) | Effect | Endpoint |
|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields10-053*** | ***Early life*** | ***Fathead minnow*** | ***0.2*** | ***Development*** | ***ED06*** |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields10-053*** | ***Early life*** | ***Fathead minnow*** | ***1.2*** | ***Development*** | ***ED19*** |

**Notes:**
EDx - Effective dose to x% of the population

The Reference Identification corresponds to references presented in the nickel reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:

Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.

Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.

Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 6**
**Critical Body Residues for Fish - Nickel (References)**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| NewFields10-053 | 2010 | Lapointe D, P Couture | Ecotox & Environ Saf 73:572-578 |

**Attachment G Table 7**
**Critical Body Residues for Fish - Selenium**

**Table 1. Summary of the Recommended Freshwater Selenium Ambient Chronic Water Quality Criterion for Protection of Aquatic Life.**

| Media Type | Fish Tissue[1] | | Water Column[4] | |
|---|---|---|---|---|
| **Criterion Element** | **Egg/Ovary [2]** | **Fish Whole Body or Muscle [3]** | **Monthly Average Exposure** | **Intermittent Exposure[5]** |
| **Magnitude** | 15.1 mg/kg dw | 8.5 mg/kg dw whole body <u>or</u> 11.3 mg/kg dw muscle (skinless, boneless filet) | 1.5 µg/L in lentic aquatic systems<br>3.1 µg/L in lotic aquatic systems | $WQC_{int} = \dfrac{WQC_{30-day} - C_{bkgrnd}(1 - f_{int})}{f_{int}}$ |
| **Duration** | Instantaneous measurement[6] | Instantaneous measurement[6] | 30 days | Number of days/month with an elevated concentration |
| **Frequency** | Not to be exceeded | Not to be exceeded | Not more than once in three years on average | Not more than once in three years on average |

1. Fish tissue elements are expressed as steady-state.
2. Egg/Ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.
3. Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.
4. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data.
5. Where WQC30-day is the water column monthly element, for either a lentic or lotic waters; $C_{bkgrnd}$ is the average background selenium concentration, and fint is the fraction of any 30-day period during which elevated selenium concentrations occur, with $f_{int}$ assigned a value $\geq$0.033 (corresponding to 1 day).
6. Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish population(s) at a given site.

Source:
USEPA. 2016. Aquatic Life Ambient Water Quality Criterion for Selenium - Freshwater 2016. U.S. Environmental Protection Agency, Office of Water. June 2016.

To convert from dry weight to wet weight, 75% moisture in the Fish (bony fish) was assumed per USEPA (1993).

| | | |
|---|---|---|
| e.g., | 15.1 mg/kg dry weight * (1-0.75) = 3.8 mg/kg wet weight | Egg/Ovary |
| | 8.5 mg/kg dry weight * (1-0.75) = 2.1 mg/kg wet weight | Adult (Whole Body) |

**Attachment G Table 8**
**Critical Body Residues for Fish - Silver**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included species | Included Effect | Included Endpoint | Reference Identification | Lifestage | Species (Common name) | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | JA88 | Early life | Bluegill | 0.044 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA88 | Early life | Bluegill | 0.044 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA88 | Early life | Bluegill | 0.12 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | MEC03-038 | Early life | Trout - rainbow | 0.24 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***MEC03-038*** | ***Early life*** | ***Trout - rainbow*** | ***0.24*** | ***Mortality*** | ***LD33*** | |
| Fish | x | x | | MEC03-054 | Not reported | Trout - rainbow | 0.003 | Mortality | NOEC | No effect values in study; lifestage not reported |
| Fish | x | | | Weston05-108 | Early life | Grunt | 2.02 | Biochemical | IP77 | |
| Fish | x | | | Weston05-108 | Early life | Grunt | 1.36 | Biochemical | IP251 | |
| Fish | x | x | | Weston05-108 | Early life | Grunt | 2.02 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston05-108 | Early life | Grunt | 1.36 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | Weston05-108 | Early life | Grunt | 2.02 | Growth | NOEC | No effect values in study |
| Fish | x | x | | Weston05-108 | Early life | Grunt | 1.36 | Growth | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-043*** | ***Early life*** | ***Trout - rainbow*** | ***0.15*** | ***Growth*** | ***EC11*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-043*** | ***Early life*** | ***Trout - rainbow*** | ***0.84*** | ***Growth*** | ***EC14*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.564*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.18*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.36*** | ***Growth*** | ***ED15*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.114*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.644*** | ***Mortality*** | ***LD99*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.114*** | ***Growth*** | ***ED33*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.644*** | ***Growth*** | ***ED99*** | |
| Fish | x | x | | NewFields07-072 | Early life | Fathead minnow | 0.644 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.336*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.536*** | ***Growth*** | ***ED32*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***1.25*** | ***Growth*** | ***ED67*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***0.14*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***NewFields07-072*** | ***Early life*** | ***Fathead minnow*** | ***1.25*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | JA88 | Early life | Bluegill | 0.06 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA88 | Early life | Bluegill | 0.06 | Growth | NOEC | No effect values in study |

**Notes:**
ECx - Effective concentration to x% of the population
EDx - Effective dose to x% of the population
IPx - Inhibition of proliferation of cells to x% of population
LDx - Dose that is lethal to x% of population
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the silver reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 8**
**Critical Body Residues for Fish - Silver (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| JA88 | 1974 | Coleman RL, JE Cearley | Bull Environ Contam Toxicol 12:53-61 |
| MEC03-038 | 2001 | Guadagnolo, C.M., C.J. Brauner, C.M. Wood | Environ Tox & Chem 20(3):553-560 |
| MEC03-054 | 2002 | Wood, C.M., M. Grosell, C. Hogstrand, H.Hansen | Aquat Toxicol 56:197-213 |
| Weston05-108 | 2005 | Long A; WX Wang | Mar Ecol Prog Ser. 291:215-226 |
| NewFields07-043 | 2007 | Dethloff, G.M., R.B. Naddy, J.W. Gorsuch | Environmental Toxicology and Chemistry 26: 1717-1725 |
| NewFields07-072 | 2007 | Naddy RB, AB Rehner, GR McNerney, JW Gorsuch, JR Kramer, CM Wood | Environ Toxicol & Chem 26(9):1922-1930 |

**Attachment G Table 9**
**Critical Body Residues for Fish - Zinc**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included species | Included Effect | Included Endpoint | Reference Identification | Lifestage | Species (Common name) | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | JA134 | Early life | Salmon - Atlantic | 12 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA134 | Early life | Salmon - Atlantic | 23.6 | Growth | NOEC | No effect values in study |
| Fish | x | | | JA134 | Early life | Salmon - Atlantic | 60 | Physiological | LOEC | |
| Fish | x | x | | JA134 | Early life | Salmon - Atlantic | 60 | Growth | NOEC | No effect values in study |
| Fish | x | x | | JA134 | Early life | Salmon - Atlantic | 60 | Mortality | NOEC | No effect values in study |
| Fish | x | | | JA134 | Early life | Salmon - Atlantic | 42 | Physiological | NOEC | |
| Fish | x | x | | JA134 | Early life | Salmon - Atlantic | 60 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | MEC03-199 | Early life | Striped mullet | 51.3 | Mortality | LD30 | |
| Fish | x | x | | MEC03-199 | Early life | Striped mullet | 28.1 | Mortality | LD60 | |
| Fish | x | x | | MEC03-199 | Early life | Striped mullet | 33.3 | Mortality | LD70 | |
| Fish | x | x | | MEC03-199 | Early life | Striped mullet | 30.8 | Mortality | LD50 | |
| Fish | x | x | | MEC03-199 | Early life | Striped mullet | 23.1 | Mortality | LD70 | |
| Fish | x | x | | MEC03-199 | Early life | Striped mullet | 33.1 | Mortality | LD100 | |
| Fish | x | | | MEC03-304 | Not reported | Yellow perch | 32.82 | Biochemical | ED37 | Lifestage not reported |
| Fish | x | | | MEC03-304 | Not reported | Yellow perch | 21.78 | Biochemical | ED33 | Lifestage not reported |
| Fish | x | x | | NewFields10-026 | Early life | Salmon - coho | 27.2 | Mortality | LC44 | |
| Fish | x | x | | NewFields10-026 | Early life | Salmon - coho | 33.4 | Mortality | LC90 | |
| Fish | x | x | | NewFields10-026 | Early life | Salmon - coho | 33.4 | Mortality | LC95 | |
| Fish | x | x | | SEQ97-10 | Early life | Guppy | 0.284 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | SEQ97-10 | Early life | Guppy | 320 - 480 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | SEQ97-10 | Early life | Guppy | 280 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-33*** | ***Early life*** | ***American flagfish*** | ***220 (a)*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-33*** | ***Early life*** | ***American flagfish*** | ***300 (b)*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-33*** | ***Early life*** | ***American flagfish*** | ***220 (c)*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-33*** | ***Early life*** | ***American flagfish*** | ***190 (a)*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-33*** | ***Early life*** | ***American flagfish*** | ***230 (b)*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-33*** | ***Early life*** | ***American flagfish*** | ***220 (c)*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-33*** | ***Early life*** | ***American flagfish*** | ***300 (c)*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | SEQ97-33 | Not reported | American flagfish | 60 - 64 | Mortality | NOEC | Lifestage not reported |
| Fish | x | x | | SEQ97-33 | Not reported | American flagfish | 60 - 64 | Growth | LOEC | Lifestage not reported |
| Fish | x | x | | SEQ97-33 | Not reported | American flagfish | 44 | Growth | NOEC | Lifestage not reported |
| Fish | x | x | | SEQ97-33 | Not reported | American flagfish | 44 | Mortality | LD80 | Lifestage not reported |
| Fish | x | x | | SEQ97-33 | Not reported | American flagfish | 40 | Mortality | NOEC | Lifestage not reported |
| Fish | x | x | | SEQ97-33 | Not reported | American flagfish | 40 | Growth | LOEC | Lifestage not reported |
| Fish | x | x | | SEQ97-33 | Not reported | American flagfish | 34 | Growth | NOEC | Lifestage not reported |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-34*** | ***Early life*** | ***American flagfish*** | ***50 (c)*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | SEQ97-34 | Early life | American flagfish | 58 | Growth | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-34*** | ***Early life*** | ***American flagfish*** | ***50 (c)*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | SEQ97-34 | Early life | American flagfish | 58 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***SEQ97-34*** | ***Early life*** | ***American flagfish*** | ***59.6 - 68*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS123*** | ***Early life*** | ***Trout - brook*** | ***4.5*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS123*** | ***Early life*** | ***Trout - brook*** | ***3.9*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | URS123 | Early life | Trout - brook | 4.5 | Mortality | NOEC | No effect values in study |
| Fish | x | | | URS30 | Adult | Trout - rainbow | 40 | Biochemical | LOEC | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 28 | Biochemical | NOEC | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 28 | Biochemical | NOEC | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 30 | Biochemical | IP180 | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 30 | Biochemical | IP200 | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 26 | Biochemical | NOEC | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 26 | Biochemical | NOEC | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 17 | Biochemical | IP180 | |
| Fish | x | | | Weston05-104 | Early life | Seabream | 16 | Biochemical | NOEC | |
| Fish | x | x | | Weston06-009 | Early life | Salmon - Atlantic | 4.8 | Growth | ED17 | |
| Fish | x | x | | Weston06-009 | Early life | Salmon - Atlantic | 4.8 | Growth | ED61 | |

**Attachment G Table 9**
**Critical Body Residues for Fish - Zinc**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included species | Included Effect | Included Endpoint | Reference Identification | Lifestage | Species (Common name) | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | Weston06-009 | Early life | Salmon - Atlantic | 4.8 | Growth | ED41 | |
| Fish | x | | | Weston06-009 | Early life | Salmon - Atlantic | 4.8 | Biochemical | NOEC | |
| Fish | x | | | Weston06-009 | Early life | Salmon - Atlantic | 4.8 | Biochemical | NOEC | |
| Fish | x | | | Weston06-009 | Early life | Salmon - Atlantic | 4.8 | Biochemical | IP232 | |
| Fish | x | | | Weston06-009 | Early life | Salmon - Atlantic | 4.8 | Biochemical | ED61 | |

**Notes:**
EDx - Effective dose to x% of the population
IPx - Inhibition of proliferation of cells to x% of population
LCx - Concentration that is lethal to x% of population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

(a) Estimated concentrations based on the total length of female fish.
(b) Estimated concentrations based on the total length of male fish.
(c) Concentrations are estimated, but details on estimation are not provided in database.
The Reference Identification corresponds to references presented in the zinc reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed June 14, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 9**
**Critical Body Residues for Fish - Zinc**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| MEC03-199 | 2000 | Zyadah, MA, E Abdel-Baky | Bull Environ Contam Toxicol 64:740-747 |
| MEC03-304 | 2000 | Sherwood GD, JB Rasmussen, DJ Rowan, J Brodeur, and A Hontela | Can J Fish Aquat Sci 57:441-450 |
| NewFields10-026 | 1993 | Borgmann, U, WP Norwood, and C Clarke | Hydrobiologia 259:78-89. |
| SEQ97-10 | 1981 | Pierson, K.B. | Can J Fish Aquat Sci 38:23–31 |
| SEQ97-33 | 1976 | Spehar, R.L. | J Fish Res Board Can 33:1939–1945 |
| SEQ97-34 | 1978 | Spehar, R.L., Leonard, E.N., Defoe, D.L. | Trans Am Fish Soc 107(2): 354-360 |
| URS123 | 1979 | Holcombe, G.W., Benoit,D.A. and E.N. Leonard | Trans Am Fish Soc 108:76-87 |
| URS30 | 1987 | Bonham, K., M. Zararullah and L. Gedamu | DNA 6:519-528. |
| JA134 | 1979 | Farmer GJ, D Ashfield, HS Samant | Environ Pollut 019:103-116 |
| Weston05-104 | 2005 | Zhang L; WX Wang | Aquat Toxicol In press |
| Weston06-009 | 2005 | Dube MG, LD MacLatchy, JD Kieffer, NE Glozier, JM Culp, KJ Cash | Sci Total Environ 343:135-154 |

**Attachment G Table 10**
**Critical Body Residues for Fish - Total PCBs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | 2157 | Early life | Channel catfish | 14 | Mortality | NOED | No effect values in study |
| Fish | x | x | | 2157 | Early life | Channel catfish | 14 | Growth | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2164*** | ***Fathead minnow*** | ***Adult*** | ***1.28*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2165*** | ***Fathead minnow*** | ***Adult*** | ***102*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | 2166 | Fathead minnow | Early life - Adult | 278 | Mortality | NOED | No effect values in study |
| Fish | x | x | | 2166 | Fathead minnow | Early life - Adult | 278 | Growth | NOED | No effect values in study |
| Fish | x | x | | 2171 | Fathead minnow | Early life - Adult | 190 | Mortality | NOED | No effect values in study |
| Fish | x | x | | 2171 | Fathead minnow | Early life - Adult | 190 | Reproduction | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2172*** | ***Fathead minnow*** | ***Early life - Adult*** | ***11*** | ***Growth*** | ***LOEC*** | |
| Fish | x | x | | 2173 | Fathead minnow | Early life - Adult | 2.8 | Growth | NOED | No effect values in study |
| Fish | x | x | | 2174 | Channel catfish | Early life | 13 | Mortality | NOED | No effect values in study |
| Fish | x | x | | 2174 | Channel catfish | Early life | 13 | Growth | NOED | No effect values in study |
| Fish | x | x | | 2187 | Coho salmon | Early life | 54 | Mortality | NOED | No effect values in study |
| Fish | x | x | | 2187 | Coho salmon | Early life | 54 | Growth | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2192*** | ***Brook trout*** | ***Early life*** | ***77.9*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | 2193 | Brook trout | Early life | 0.5 | Mortality | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2198*** | ***Brook trout*** | ***Early life*** | ***71*** | ***Growth*** | ***LOEC*** | |
| Fish | x | x | | 2202 | Lake trout | Early life | 0.0002 | Mortality | NOED | Lifestage limited to fry |
| Fish | x | x | | 2202 | Lake trout | Early life | 0.0002 | Growth | NOED | Lifestage limited to fry |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2203*** | ***Fathead minnow*** | ***Adult*** | ***648*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | 2204 | Fathead minnow | Early life - Adult | 741 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | 2204 | Fathead minnow | Early life - Adult | 741 | Growth | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2205*** | ***Fathead minnow*** | ***Early life - Adult*** | ***83*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | x | 2206 | Fathead minnow | Early life - Adult | 54 | Reproduction | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | 2207 | Channel catfish | Early life | 21 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | 2207 | Channel catfish | Early life | 21 | Growth | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2229*** | ***Fathead minnow*** | ***Adult*** | ***0.36*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2230*** | ***Fathead minnow*** | ***Adult*** | ***161*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | x | 2231 | Fathead minnow | Early life - Adult | 350 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | 2231 | Fathead minnow | Early life - Adult | 350 | Growth | NOED | No effect values in study |
| Fish | x | x | x | 2231 | Fathead minnow | Early life - Adult | 350 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | 2232 | Channel catfish | Early life | 32 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | 2232 | Channel catfish | Early life | 32 | Growth | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***2233*** | ***Fathead minnow*** | ***Adult*** | ***0.45*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | x | JA156 | Rainbow trout | Early life | 1 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | JA157 | Rainbow trout | Early life | 1 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | JA157 | Rainbow trout | Adult | 4.20 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | JA178 | Channel catfish | Early life | 2.17 | Mortality | NOED | No effect values in study |
| Fish | x | x | | JA204 | Rainbow trout | Early life | 2.70 | Mortality | ED75 | |
| Fish | x | x | x | JA258 | Rainbow trout | Early life | 8.20 | Growth | NOED | No effect values in study |
| Fish | x | x | x | JA258 | Rainbow trout | Early life | 8.20 | Mortality | NOED | No effect values in study |
| Fish | x | x | | JA264 | Lake trout | Early life | 156 | Growth | ED107 | |
| Fish | x | x | | JA264 | Lake trout | Early life | 202 | Growth | ED112 | |
| Fish | x | x | | JA264 | Lake trout | Early life | 206 | Growth | ED113 | |
| Fish | x | x | | JA264 | Lake trout | Early life | 156 | Growth | ED129 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA264*** | ***Lake trout*** | ***Early life*** | ***202*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA264*** | ***Lake trout*** | ***Early life*** | ***182*** | ***Growth*** | ***NOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA264*** | ***Lake trout*** | ***Early life*** | ***182*** | ***Growth*** | ***NOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA264*** | ***Lake trout*** | ***Early life*** | ***202*** | ***Growth*** | ***NOED*** | |
| Fish | x | x | x | JA264 | Lake trout | Early life | 156 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | JA264 | Lake trout | Early life | 206 | Mortality | NOED | No effect values in study |
| Fish | x | x | | JA278 | Brook trout | Early life | 419 | Mortality | LD100 | |
| Fish | x | x | | JA278 | Brook trout | Early life | 284 | Mortality | LD50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA278*** | ***Brook trout*** | ***Early life*** | ***125*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | x | JA278 | Brook trout | Early life | 31 | Growth | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA278*** | ***Brook trout*** | ***Early life*** | ***71*** | ***Mortality*** | ***NOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA28*** | ***Lake trout*** | ***Early life*** | ***1.53*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | x | JA28 | Lake trout | Early life | 26.3 | Growth | NOED | No effect values in study |
| Fish | x | x | x | JA324 | Rainbow trout | Early life | 81 | Growth | NOED | No effect values in study |
| Fish | x | x | x | JA324 | Rainbow trout | Early life | 81 | Mortality | NOED | No effect values in study |
| Fish | x | x | | JA344 | Guppy | Adult | 2.6 | Mortality | LD22 | |
| Fish | x | x | | JA344 | Guppy | Adult | 2.6 | Mortality | LD22 | |
| Fish | x | x | | JA41 | Zebra Danio | NS | 4240 | Mortality | LD82 | |
| Fish | x | x | x | JA41 | Zebra Danio | NS | 4240 | Growth | NOED | No effect values in study |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 0.074 | Mortality | LD50 | |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 0.6 | Mortality | LD100 | |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 0.08 | Mortality | LD15 | |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 0.0 | Mortality | LD50 | |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 1.348 | Mortality | LD50 | |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 0.2 | Mortality | LD65 | |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 0.0 | Mortality | LD50 | |
| Fish | x | x | | JA472 | Rainbow trout | Early life | 0.0 | Mortality | LD50 | |
| Fish | x | x | | JA496 | Lake trout | Early life | 0.000054 | Mortality | LD50 | |
| Fish | x | x | | JA496 | Lake trout | Early life | 0.029 | Mortality | LD50 | |
| Fish | x | x | | JA53 | Chinook salmon | Early life | 3.6 | Mortality | LD100 | |
| Fish | x | x | | JA53 | Lake trout | Early life | 7.6 | Mortality | LD91 | |
| Fish | x | x | | JAW8 | Coho salmon | Early life | 645 | Mortality | ED100 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JAW9*** | ***Rainbow trout*** | ***Early life*** | ***1.3*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | x | MEC03-072 | Chinook salmon | Juvenile | 0.2 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC03-072 | Chinook salmon | Juvenile | 1.0 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC03-072 | Chinook salmon | Juvenile | 1.0 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC03-072 | Chinook salmon | Juvenile | 0.2 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC03-072 | Chinook salmon | Juvenile | 0.7 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC03-072 | Chinook salmon | Juvenile | 1.0 | Growth | NOED | No effect values in study |

**Attachment G Table 10**
**Critical Body Residues for Fish - Total PCBs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | x | MEC03-072 | Chinook salmon | Juvenile | 1.0 | Growth | NOED | No effect values in study |
| Fish | | x | x | MEC03-135 | Mummichog | Adult | 15 | Mortality | NOED | No effect values in study |
| Fish | | x | x | MEC03-135 | Killfish | Adult | 15 | Mortality | NOED | No effect values in study |
| Fish | | x | x | MEC03-135 | Mummichog | Adult | 15 | Growth | NOED | No effect values in study |
| Fish | | x | x | MEC03-135 | Killfish | Adult | 15 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC03-339 | Arctic Grayling | Early life | 1.7 | Growth | NOED | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-046*** | ***Zebra Danio*** | ***Adult*** | ***0.14*** | ***Mortality*** | ***NOED*** | |
| Fish | x | x | | MEC04-046 | Zebra Danio | Adult | 1.1 | Mortality | LD07 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-046*** | ***Zebra Danio*** | ***Adult*** | ***1.9*** | ***Growth*** | ***NOED*** | |
| Fish | x | x | | MEC04-046 | Zebra Danio | Adult | 2.7 | Growth | ED59 | |
| Fish | x | x | x | MEC04-046 | Zebra Danio | Adult | 0.14 | Reproduction | NOED | No effect values in study |
| Fish | x | x | | MEC04-046 | Zebra Danio | Adult | 1.10 | Reproduction | ED47 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-046*** | ***Zebra Danio*** | ***Adult*** | ***1.1*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | MEC04-046 | Zebra Danio | Adult | 2.7 | Mortality | LD18 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-046*** | ***Zebra Danio*** | ***Adult*** | ***0.14*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-046*** | ***Zebra Danio*** | ***Adult*** | ***1.9*** | ***Reproduction*** | ***NOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***MEC04-046*** | ***Zebra Danio*** | ***Adult*** | ***1.1*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | | MEC04-046 | Zebra Danio | Adult | 2.7 | Reproduction | ED54 | |
| Fish | x | x | x | MEC04-274 | Largemouth Bass | Adult | 121 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-274 | Largemouth Bass | Early life | 28 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 78.6 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 78.6 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 78.6 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 109 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 109 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 109 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 80.9 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 80.9 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 80.9 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 177 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 177 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 177 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 69.2 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 69.2 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 69.2 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 130 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 130 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 130 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 82.6 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 82.6 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 82.6 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 183.3 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 183.3 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 183.3 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 78.2 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 78.2 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 78.2 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 73.1 | Reproduction | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 73.1 | Growth | NOED | No effect values in study |
| Fish | x | x | x | MEC04-282 | Fathead minnow | Early life | 73.1 | Mortality | NOED | No effect values in study |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 8.8 | Mortality | LD17 | |
| Fish | x | x | | SEQ98-40 | Chinook salmon | Early life | 3.7 | Mortality | LD28 | |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 9.2 | Mortality | LD50 | |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 8.6 | Mortality | LD74 | |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 8.4 | Mortality | LD87 | |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 8.8 | Mortality | LD17 | |
| Fish | x | x | | SEQ98-40 | Chinook salmon | Early life | 3.7 | Mortality | LD28 | |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 9.2 | Mortality | LD50 | |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 8.6 | Mortality | LD74 | |
| Fish | x | x | | SEQ98-40 | Lake trout | Early life | 8.4 | Mortality | LD87 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS104*** | ***Channel catfish*** | ***Early life*** | ***14.3*** | ***Growth*** | ***LOEC*** | |
| Fish | x | x | x | URS104 | Channel catfish | Early life | 10.9 | Mortality | NOED | No effect values in study |
| Fish | x | x | x | URS104 | Channel catfish | Early life | 14.3 | Mortality | NOED | No effect values in study |
| Fish | x | x | | URS109 | Goldfish | NS | 250.0 | Mortality | LD50 | |
| Fish | x | x | | URS109 | Goldfish | Early life | 324.0 | Mortality | LD50 | |
| Fish | x | x | x | URS131 | Rainbow trout | NS | 2.0 | Mortality | NOED | Injection-based study |
| Fish | x | x | x | URS131 | Rainbow trout | NS | 2.0 | Mortality | NOED | Injection-based study |
| Fish | x | x | | URS14 | Minnow | Adult | 170.0 | Reproduction | ED83 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS14*** | ***Minnow*** | ***Adult*** | ***180*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS14*** | ***Minnow*** | ***Adult*** | ***70*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS14*** | ***Minnow*** | ***Adult*** | ***15*** | ***Reproduction*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS14*** | ***Minnow*** | ***Adult*** | ***1.6*** | ***Reproduction*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS173*** | ***Lake trout*** | ***Early life*** | ***1.8*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS173*** | ***Lake trout*** | ***Early life*** | ***2.4*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS173*** | ***Lake trout*** | ***Early life*** | ***0.76*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | x | URS173 | Lake trout | Early life | 1.80 | Mortality | NOEC | No effect values in study |
| Fish | x | x | x | URS173 | Lake trout | Early life | 2.40 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS234*** | ***Striped Bass*** | ***Early life*** | ***4.4*** | ***Growth*** | ***NOEC*** | |
| Fish | x | x | x | URS51 | Atlantic salmon | Early life | 44 | Mortality | NOEC | No effect values in study |
| Fish | x | x | x | URS84 | Coho salmon | Early life | 0.15 | Mortality | LOEC | Injection-based study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS94*** | ***Coho salmon*** | ***Early life*** | ***2.3*** | ***Growth*** | ***LOEC*** | |

**Attachment G Table 10**
**Critical Body Residues for Fish - Total PCBs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS94*** | ***Coho salmon*** | ***Early life*** | ***0.6*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Weston06-065*** | ***Brook trout*** | ***NS*** | ***0.15*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Weston06-065*** | ***Rainbow trout*** | ***NS*** | ***0.28*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Weston06-065*** | ***Rainbow trout*** | ***NS*** | ***0.46*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Weston06-065*** | ***Coho salmon*** | ***NS*** | ***250*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Weston06-065*** | ***Atlantic salmon*** | ***NS*** | ***1.1*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Weston06-065*** | ***Brook trout*** | ***NS*** | ***12.5*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Weston06-065*** | ***Rainbow trout*** | ***NS*** | ***150*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Niimi 1996*** | ***Trout & minnow*** | ***NS*** | ***>30*** | ***Reproduction*** | ***Reduced spawning/ hatching succcess*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Niimi 1996*** | ***Minnow*** | ***NS*** | ***350*** | ***Reproduction*** | ***NOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Nebeker et al. 1974*** | ***Fathead minnow*** | ***NS*** | ***105*** | ***Reproduction*** | ***NOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Nebeker et al. 1974*** | ***Fathead minnow*** | ***NS*** | ***429*** | ***Reproduction*** | ***LOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Hansen et al. 1974*** | ***Sheepshead minnow*** | ***NS*** | ***1.9*** | ***Reproduction*** | ***NOED*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***Hansen et al. 1974*** | ***Sheepshead minnow*** | ***NS*** | ***9.3*** | ***Reproduction*** | ***LOED*** | |

Notes:
EDx - Effective dose to x% of the population
LDx - Dose that is lethal to x% of population
LOEC/LOED - Lowest observed effect concentration/dose.
NOEC/NOED - No observed effect concentration/dose.

The Reference Identification corresponds to references presented in the PCB reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Reproduction, Growth, and Survival/Mortality effects.
4 - Identify no-effect values that have no associated effects values and exclude the no-effect values.
5 - Identify range of acceptable no-effect and low-effect results for the selected receptor and effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable no-effect or low-effect values are identified.

**Attachment G Table 10**
**Critical Body Residues for Fish - Total PCBs (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 2157 | 1977 | Mayer FL, Mehrle PM, Sanders HO | Arch Environ Contam Toxicol 5:501–511 |
| 2164 | 1995 | van Wezel AP, de Vries DAM, Kostense S, | Aquat Toxicol 33:325–342 |
| 2165 | 1995 | van Wezel AP, de Vries DAM, Kostense S, | Aquat Toxicol 33:325–342 |
| 2166 | 1974 | Nebeker AV, Puglisi FA, DeFoe DL | Trans Am Fish Soc 103:562–568 |
| 2171 | 1978 | DeFoe DL, Veith GD, Carlson RW | J Fish Res Board Can 35:997–1002 |
| 2172 | 1978 | DeFoe DL, Veith GD, Carlson RW | J Fish Res Board Can 35:997–1002 |
| 2173 | 1978 | DeFoe DL, Veith GD, Carlson RW | J Fish Res Board Can 35:997–1002 |
| 2174 | 1977 | Mayer FL, Mehrle PM, Sanders HO | Arch Environ Contam Toxicol 5:501–511 |
| 2187 | 1977 | Mayer FL, Mehrle PM, Sanders HO | Arch Environ Contam Toxicol 5:501–511 |
| 2192 | 1975 | Freeman HC, Idler DR | Can J Biochem 53:666–670 |
| 2193 | 1975 | Freeman HC, Idler DR | Can J Biochem 53:666–670 |
| 2198 | 1978 | Mauck WL, Mehrle PM, Mayer FL | J Fish Res Board Can 35:1084–1088 |
| 2202 | 1981 | Mac MJ, Seelye JG | Bull Environ Contam Toxicol 27:359–367 |
| 2203 | 1995 | van Wezel AP, de Vries DAM, Kostense S, | Aquat Toxicol 33:325–342 |
| 2204 | 1974 | Nebeker AV, Puglisi FA, DeFoe DL | Trans Am Fish Soc 103:562–568 |
| 2205 | 1974 | Nebeker AV, Puglisi FA, DeFoe DL | Trans Am Fish Soc 103:562–568 |
| 2206 | 1974 | Nebeker AV, Puglisi FA, DeFoe DL | Trans Am Fish Soc 103:562–568 |
| 2207 | 1977 | Mayer FL, Mehrle PM, Sanders HO | Arch Environ Contam Toxicol 5:501–511 |
| 2229 | 1995 | van Wezel AP, de Vries DAM, Kostense S, | Aquat Toxicol 33:325–342 |
| 2230 | 1995 | van Wezel AP, de Vries DAM, Kostense S, | Aquat Toxicol 33:325–342 |
| 2231 | 1978 | DeFoe DL, Veith GD, Carlson RW | J Fish Res Board Can 35:997–1002 |
| 2232 | 1977 | Mayer FL, Mehrle PM, Sanders HO | Arch Environ Contam Toxicol 5:501–511 |
| 2233 | 1995 | van Wezel AP, de Vries DAM, Kostense S, | Aquat Toxicol 33:325–342 |
| JA156 | 1980 | Guiney, P.D., J.J. Lech, and R.E. Peterson.. | Toxicol Appl Pharmacol 053:521-529 |
| JA157 | 1977 | Guiney, P.D., R.E. Peterson, M.J. Melancon, Jr., and J.J. Lech.. | Toxicol Appl Pharmacol 039:329-338 |
| JA178 | 1976 | Hansen LG, WB Wiekhurst, J Simon | J Fish Res Board Can 33:1343-1352 |
| JA204 | 1975 | Hogan JW, JL Brauhn | Prog Fish Cult 37:229-230 |
| JA258 | 1974 | Lieb, A.J., D.D. Bills, and R.O. Sinnhuber.. | J. Agr. Food Chem., 22(4):638-642. |
| JA264 | 1981 | Mac MJ, JC Seelye | Bull Environ Contam Toxicol 27:359- 367 |
| JA278 | 1978 | Mauck, W.L., P.M. Mehrle, and F.L. Mayer.. | J Fish Res Bd Can 35:1084-1088 |
| JA28 | 198 | Berlin, W.H., R.J. Hesselberg, and M.J. Mac. | In Chlorinated Hydrocarbons as a Factor in the |
| JA324 | 1975 | Nestel H, Budd J | Can J Comp Med 39:208-215 |
| JA344 | 1988 | Opperhuizen A, SM Schrap | Chemosphere 17:253-262 |
| JA41 | 1989 | Bouraly M, RJ Millischer.. | Chemosphere 18:2051-2063 |
| JA472 | 1991 | Walker MK and RE Peterson | Aquat Toxicol 21:219-238 |
| JA496 | 1995 | Zabel EW, PM Cook, RE Peterson | Environ Tox & Chem 14:2175-2179 |
| JA53 | 1979 | Broyles RH, MI Noveck | Toxicol Appl Pharmacol 050:299-308 |
| JAW8 | 1977 | Mayer, F.L., P.M. Mehrle, and H.O. Sanders. | Arch Environ Contam Toxicol 05:501-511 |
| JAW9 | 1975 | Hogan, J.W., and J.L. Brauhn. | The Progressive Fish Culturist 37 (4):229-230 |
| MEC03-072 | 2003 | Powell DB, RC Palm Jr. A Skillman, K Godtfredsen | Environ Tox & Chem |
| MEC03-135 | 2001 | Matta MB, J Linse, C Cairncross, L Francendese, RM Kocan | Environ Tox & Chem 20(2):327-335 |

**Attachment G Table 10**
**Critical Body Residues for Fish - Total PCBs (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| MEC03-339 | 2001 | Palace, V.P., S.M. Allen-Gil, S.B. Brown, R.E. Evans, D.A. Metner, D.H. Landers, L.R. Curtis, J.F. Klaverkamp, C.L. Baron, W. L. Lockhart. | Chemosphere 45:185-193 |
| MEC04-274 | 2004 | Reiser DW, ES Greenberg, TE Helser, M Branton, KD Jenkins | Environ Tox & Chem 23:1762-1773 |
| MEC04-046 | 1998 | Orn, S., P.L. Anderson, L. Forlin, M. Tysklind, | Arch Environ Contam Toxicol 35:53-57 |
| SEQ98-40 | 1979 | Broyles, R.H. and M.I. Noveck. | Toxicology and Applied Pharmacology 50, 299-308 |
| URS131 | 1991 | Janz, D.M. and C.D. Metcalfe. | Environ Tox & Chem 10:917-923 |
| URS104 | 1976 | Hansen, L.G., W.B. Wiekhorst and J. Simon. | J Fish Res Bd Can 33:1343-1352 |
| URS14 | 1980 | Bengtsson, B.E.. | Water Res, 14:681-687 |
| URS173 | 198 | Mac, M.J. and J.G. Seelye. | Bull Environ Contam Toxicol 27:359- 367 |
| URS234 | 1983 | Westin, D.T., Olney, C.E., Rogers, B.A.. | Bull Environ Contam Toxicol 30:50-57 |
| URS51 | 1986 | Carlberg, G.E., K. Martinsen, A. Kringstad, E. Gjessing, M. Grande, T. Kallqvist and J.U. | Arch Environ Contam Toxicol 15:543-548 |
| URS84 | 1982 | Folmar, L.C., W.W. Dickhoff, W.S. Zaugg and H.O. Hodgins. | Aquat Toxicol 02:291-299 |
| Niimi 1996 | 1996 | Niimi AJ. | Environmental Contaminants in Wildlife Interpreting |
| Nebeker et al. 1974 | 1974 | Nebeker AV, Puglisi FA, DeFoe DL. | Trans Am Fish Soc 3:562-568. |
| Hansen et al. 1974 | 1974 | Hansen DJ,Schimmel SC, and Forester J. | Proceedings of Southeastern Game Fish Commission |
| URS94 | 1976 | Gruger, E.H., T. Hurley and N.L. Karrick. | Environ Sci Tech 10:1033-1037 |
| Weston06-065 | 2002 | Meador JP, TK Collier and JE Stein | Aquatic Conserv: Mar. Freshw Ecosyst. 12:493-516 |
| MEC04-282 | 1997 | Suedel BC, T Dillon, WH Benson | Environ Tox & Chem. 16(7):1526-1532 |
| URS109 | 1972 | Hattula ML and O Karlog | Acta Pharmacol. Toxicol. 31:238-240 |

**Attachment G Table 11**
**Critical Body Residues for Fish - Total PAHs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Chemical | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | x - no LOECs | NewFields07-068 | Salmon - Chinook | Early life | Total PAHs | 0.073 | Growth | ED04 | |
| Fish | x | x | x | NewFields07-068 | Salmon - Chinook | Early life | Total PAHs | 0.38 | Growth | NOEC | |
| Fish | x | x | x - no LOECs | NewFields07-068 | Salmon - Chinook | Early life | Total PAHs | 2.3 | Growth | ED09 | |
| Fish | x | x | x - no LOECs | NewFields07-068 | Salmon - Chinook | Early life | Total PAHs | 1.9 | Growth | ED25 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 13.7 | Development | ED10 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 13.7 | Mortality | LD54 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 13.7 | Growth | ED35 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 13.7 | Development | IP375 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 13.7 | Behavior | ED90 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.108 | Development | ED09 | |
| Fish | | x | x | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.022 | Mortality | NOEC | |
| Fish | | x | x | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.108 | Mortality | NOEC | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.15 | Mortality | LD14 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.108 | Growth | ED14 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.15 | Development | ED18 | |
| Fish | | x | x | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.022 | Growth | NOEC | |
| Fish | | x | x | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.022 | Behavior | NOEC | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.108 | Behavior | ED14 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.15 | Behavior | ED73 | |
| Fish | | x | x | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.022 | Development | NOEC | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.108 | Development | ED38 | |
| Fish | | x | x | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.022 | Development | NOEC | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.108 | Development | ED36 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.022 | Development | ED10 | |
| Fish | | x | | NewFields09-14 | Pacific Herring | Early life | Total PAHs | 0.108 | Development | ED35 | |
| Fish | x | x | x | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 0.2 | Mortality | NOEC | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 1.8 | Mortality | LD05 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 15 | Mortality | LD09 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 50 | Mortality | LD21 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 0.3 | Mortality | LD05 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 25 | Mortality | LD50 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 25 | Development | ED97 | |
| Fish | x | x | x | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 1.9 | Mortality | NOEC | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 13 | Mortality | LD08 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 0.4 | Mortality | LD13 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 0.47 | Mortality | LD35 | |
| Fish | x | x | x - no LOECs | NewFields09-15 | Salmon - Pink | Early life | Total PAHs | 0.47 | Development | ED10 | |
| Fish | x | x | x | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 0.3 | Mortality | NOEC | |
| Fish | x | x | x | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 1.06 | Mortality | NOEC | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 2.64 | Mortality | LD43 | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 0.38 | Mortality | LD11 | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 1.2 | Mortality | LD18 | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 1.42 | Mortality | LD06 | |
| Fish | x | x | x | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 1.56 | Mortality | NOEC | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 2.6 | Mortality | LD15 | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 0.094 | Mortality | LD29 | |
| Fish | x | x | x | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 0.3 | Development | NOEC | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 2.64 | Development | ED09 | |
| Fish | x | x | x - no LOECs | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 14.2 | Mortality | LD40 | |
| Fish | x | x | x | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 1.42 | Development | NOEC | |
| Fish | x | x | x | Weston06-078 | Salmon - Pink | Early life | Total PAHs | 1.56 | Development | NOEC | |
| Fish | x | x | | URS10 | Bluegill | Early life | Acenaphthene | 3.5 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | NewFields07-013 | Fathead minnow | Early life | Anthracene | 3.75 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | NewFields07-013 | Fathead minnow | Early life | Anthracene | 8 | Mortality | NOEC | No effects values in study |
| Fish | x | x | x - no LOECs | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 12.34 | Growth | ED5 | |
| Fish | x | x | x - no LOECs | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 12.34 | Mortality | LD46 | |
| Fish | x | x | | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 12.34 | Reproduction | NOEC | No effects values in study |
| Fish | x | x | | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 12.3 | Development | NA | No endpoint identified |
| Fish | x | x | | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 1.93 | Reproduction | NA | No endpoint identified |
| Fish | x | x | | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 7.18 | Reproduction | NA | No endpoint identified |
| Fish | x | x | | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 10.2 | Reproduction | NA | No endpoint identified |
| Fish | x | x | | JA167 | Trout - Rainbow | Early life | Benzo[a]pyrene | 12.3 | Reproduction | NA | No endpoint identified |
| Fish | | x | | URS126 | Sand Sole | Early life | Benzo[a]pyrene | 2.1 | Mortality | LD50 | |
| Fish | | x | x | URS126 | Sand Sole | Early life | Benzo[a]pyrene | 2.1 | Development | LOEC | |
| Fish | x | x | x - no LOECs | NewFields07-013 | Japanese medaka | Early life | Fluoranthene | 2.8 | Mortality | LD50 | |
| Fish | x | x | x - no LOECs | MEC04-020 | Fathead minnow | Early life | Naphthalene | 1025.36 | Mortality | LD100 | |
| Fish | x | x | x | URS163 | Mummichog | Adult | Naphthalene | 17 | Mortality | LOEC | |
| Fish | x | x | x | URS163 | Killfish | Adult | Naphthalene | 17 | Mortality | LOEC | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 79 | Mortality | LD10 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 149 | Mortality | LD10 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 164 | Mortality | LD10 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 173 | Mortality | LD15 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 349 | Mortality | LD15 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 75 | Mortality | LD20 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 115 | Mortality | LD20 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 215 | Mortality | LD20 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 235 | Mortality | LD20 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 152 | Mortality | LD25 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 305 | Mortality | LD25 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 313 | Mortality | LD25 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 155 | Mortality | LD30 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 244 | Mortality | LD30 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 296 | Mortality | LD30 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 299 | Mortality | LD30 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 342 | Mortality | LD30 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 200 | Mortality | LD35 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 226 | Mortality | LD35 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 236 | Mortality | LD35 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 300 | Mortality | LD40 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 313 | Mortality | LD40 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 72 | Mortality | LD5 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 77 | Mortality | LD5 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 149 | Mortality | LD5 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 150 | Mortality | LD5 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 150 | Mortality | LD5 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 150 | Mortality | LD5 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 301 | Mortality | LD50 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 215 | Mortality | LD70 | |
| Fish | x | x | | JA234 | Goldfish | Adult | Phenanthrene | 245 | Mortality | LD80 | |

**Attachment G Table 11**
**Critical Body Residues for Fish - Total PAHs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Chemical | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | ***x*** | ***JA234*** | ***Goldfish*** | ***Adult*** | ***Phenanthrene*** | ***17*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | ***x*** | ***JA234*** | ***Goldfish*** | ***Adult*** | ***Phenanthrene*** | ***18*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | ***x*** | ***JA234*** | ***Goldfish*** | ***Adult*** | ***Phenanthrene*** | ***18*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | ***x*** | ***JA234*** | ***Goldfish*** | ***Adult*** | ***Phenanthrene*** | ***51*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | ***x*** | ***JA234*** | ***Goldfish*** | ***Adult*** | ***Phenanthrene*** | ***75*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | ***x*** | ***JA234*** | ***Goldfish*** | ***Adult*** | ***Phenanthrene*** | ***115*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***MEC03-108*** | ***Trout - Rainbow*** | ***Early life*** | ***Phenanthrene*** | ***33800*** | ***Development*** | ***ED100*** | |

**Notes:**
EDx - Dose that is effective to x% of population
IPx - Inhibition of proliferation of cells to x% of population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the Total PAHs reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.

Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed June 14, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.

Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 11**
**Critical Body Residues for Fish - Total PAHs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| JA167 | 1982 | Hannah JB, JE Hose, ML Landolt, BS Miller, SP Felton, WT Iwaoka | Arch Environ Contam Toxicol 11:727-734 |
| JA234 | 1995 | Kishino T, K Kobayashi | Water Res 29:431-442 |
| MEC03-108 | 2002 | Hawkins SA, SM Billiard, SP Tabash, RS Brown, PV Hudson | Environ Tox & Chem 21(9)1845-1853 |
| MEC04-020 | 1997 | Gert-Jan de Maagd P, ICM van de Klundert, AP van Wezel, A Opperhuizen, DTHM Sijm | Ecotoxicol Environ Saf 38:232-237 |
| NewFields07-013 | 2006 | Diamond SA, DR Mount, VR Mattson, LJ Heinis | Environmental Toxicology and Chemistry 25:3015-3023 |
| NewFields07-068 | 2006 | Meador JP, FC Sommers, GM Ylitalo, CA Sloan | Can J Fish Aquat Sci 63:2364-2376 |
| NewFields09-14 | 1999 | Carls MG, SD Rice, JE Hose | Environ Tox & Chem 18(3):481-493 |
| NewFields09-15 | 1999 | Heintz RA, JW Short, SD Rice | Environ Tox & Chem 18(3):494-503 |
| URS10 | 1980 | Barrows, M.E., S.R. Petrocelli, K.J. Macek and J.J. Carroll | p. 379-392 in Haque, R., ed. Dynamics, Exposure and Hazard Assessment of Toxic Chemicals |
| URS126 | 1982 | Hose JE, JB Hannah, D DiJulio, ML Landholt, BS miller, WT Iwaoka, SP Felton | Arch Environ Contam Toxicol 11:167-171. |
| URS163 | 1979 | Levitan, W.N. and M.N. Taylor | J Fish Res Bd Can 36:615-622. |
| Weston06-078 | 2006 | Brannon EL, KM Collins, JS Brown, JM Neff, KR Parker, WA Stubblefield | Environ Tox & Chem 25(4):962-972 |

**Attachment G Table 12**
**Critical Body Residues for Fish - 4,4-DDD**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3376*** | ***fathead Minnow*** | ***Adult*** | ***0.6*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | | 5058 | Mosquito fish | not reported | 39.1 | Mortality | NOEC | Lifestage not reported |
| Fish | x | x | | 2902 | brook trout | Early life | 5 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 2906 | brook trout | Early life | 5 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | 3977 | brook trout | Early life | 4.79 | Behavior | NOEC | No effect values in study |
| Fish | x | x | | JA476 | brook trout | Early life | 0.008 | Mortality | NOEC | No effect values in study |

Notes:
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the DDD reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:

Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.

Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.

Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 12**
**Critical Body Residues for Fish - 4,4-DDD (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 3376 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 5058 | 1974 | Metcalf. | Book |
| 2902 | 1977 | Addison and Zinck. | J Fish Res Board Can 34:119-122 |
| 2906 | 1977 | Addison and Zinck. | J Fish Res Board Can 34:119-122 |
| 3977 | 1973 | Peterson. | J Fish Res Board Can 30:1091-1097 |
| JA476 | 1996 | Wang JS, Simpson KL. | Bull Environ Contam Toxicol 56:888–895. |

**Attachment G Table 13**
**Critical Body Residues for Fish - 4,4-DDE**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | 5059 | Mosquito fish | not reported | 150 | Mortality | NOEC | Lifestage not reported; no effect values in study |
| Fish | x | x | | 14635 | largemouth bass | Adult | 40 | Reproduction | NOEC | No effect values in study |
| Fish | x | x | | 14636 | largemouth bass | Adult | 40 | Reproduction | NOEC | No effect values in study |
| Fish | x | x | | 14637 | largemouth bass | Adult | 40 | Reproduction | NOEC | No effect values in study |
| Fish | x | x | | 14638 | largemouth bass | Adult | 40 | Reproduction | NOEC | No effect values in study |
| Fish | x | x | | 14639 | largemouth bass | Adult | 75 | Reproduction | IP 479 | |
| Fish | x | x | | 14640 | largemouth bass | Adult | 40 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***14641*** | ***largemouth bass*** | ***Adult*** | ***40*** | ***Reproduction*** | ***ED 37*** | |
| Fish | x | x | | 14642 | largemouth bass | Adult | 40 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***1610*** | ***lake trout*** | ***Early life*** | ***0.29*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | 1612 | lake trout | Early life | 2.68 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 2903 | brook trout | Early life | 5 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 2907 | brook trout | Early life | 5 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3975*** | ***brook trout*** | ***Early life*** | ***44.9*** | ***Behavior*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5532*** | ***lake trout*** | ***Early life*** | ***0.74*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5533*** | ***lake trout*** | ***Early life*** | ***2.48*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA476 | brook trout | Early life | 0.042 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA28 | lake trout | Early life | 2.68 | Growth | NOEC | No effect values in study |

Notes:
EDx - Effective dose to x% of the population
IPx - Inhibition of proliferation of cells to x% of population
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the DDE reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

# Attachment G Table 13
# Critical Body Residues for Fish - 4,4-DDE (References)
# Benning Road Facility RI/FS Project
# 3400 Benning Rd, N.E., Washington DC 20019

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 5059 | 1974 | Metcalf. | Book |
| 14635 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14636 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14637 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14638 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14639 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14640 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14641 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14642 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 1610 | 1981 | Berlin et al. | Report. |
| 1612 | 1981 | Berlin et al. | Report. |
| 2903 | 1977 | Addison and Zinck. | J Fish Res Board Can 34:119-122 |
| 2907 | 1977 | Addison and Zinck. | J Fish Res Board Can 34:119-122 |
| 3975 | 1973 | Peterson. | J Fish Res Board Can 30:1091-1097 |
| 5532 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| 5533 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| JA476 | 1996 | Wang JS, Simpson KL. | Bull Environ Contam Toxicol 56:888–895. |
| JA28 | 1981 | Berlin WH, Hesselberg RJ, Mac MJ. | Ann Arbor MI: U.S. Fish and Wildlife Service. Technical Paper 105. p 11–22. |

**Attachment G Table 14**
**Critical Body Residues for Fish - 4,4-DDT**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | | x | | 459 | green sunfish | Early life | 24 | Mortality | LOEC | |
| Fish | | x | | 460 | pumpkinseed | Early life | 24 | Mortality | LOEC | |
| Fish | | x | | 758 | fathead Minnow | Early life | 57 | Mortality | LD 25 | |
| Fish | x | x | | 759 | fathead Minnow | Early life | 86 | Mortality | LD 26 | |
| Fish | x | x | | 760 | fathead Minnow | Early life | 160 | Mortality | LD 50 | |
| Fish | x | x | | 761 | fathead Minnow | Early life | 209 | Mortality | LD 79 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***762*** | ***fathead Minnow*** | ***Early life*** | ***24*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | 763 | fathead Minnow | Early life | 58.2 | Growth | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***764*** | ***fathead Minnow*** | ***Early life*** | ***6.7*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***765*** | ***fathead Minnow*** | ***Early life*** | ***40*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | 766 | fathead Minnow | Adult | 24 | Reproduction | ED 17 | |
| Fish | x | x | | 767 | fathead Minnow | Early life | 87.9 | Mortality | LD 100 | |
| Fish | x | x | | 768 | fathead Minnow | Early life | 96 | Mortality | LD 100 | |
| Fish | x | x | | 769 | fathead Minnow | Early life | 0.2 | Mortality | LD 88 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***770*** | ***fathead Minnow*** | ***Adult*** | ***68.9*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***771*** | ***fathead Minnow*** | ***Adult*** | ***24*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | | 772 | fathead Minnow | Early life | 46.4 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 773 | fathead Minnow | Early life | 58.2 | Growth | NOEC | No effect values in study |
| Fish | x | | | 774 | fathead Minnow | Adult | 337.3 | Physiological | NOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***775*** | ***fathead Minnow*** | ***Adult*** | ***12.2*** | ***Reproduction*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***776*** | ***fathead Minnow*** | ***Adult*** | ***19*** | ***Reproduction*** | ***NOEC*** | |
| Fish | | x | | 2772 | Atlantic menhaden | Early life | 0.11 | Growth | NOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3374*** | ***fathead Minnow*** | ***Adult*** | ***3.8*** | ***Reproduction*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3375*** | ***fathead Minnow*** | ***Adult*** | ***24*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | | 5054 | Mosquito fish | not reported | 54.2 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5799*** | ***Bluegill*** | ***Early life*** | ***4.2*** | ***Behavior*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5800*** | ***goldfish*** | ***Early life*** | ***5.1*** | ***Behavior*** | ***LOEC*** | |
| Fish | | x | | 5911 | Picked dogfish | not reported | 0.1 | Mortality | NOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***1403*** | ***brook trout*** | ***Early life*** | ***7.6*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***1405*** | ***brook trout*** | ***Early life*** | ***2.9*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***1406*** | ***brook trout*** | ***Early life*** | ***7.6*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | | 1407 | brook trout | Early life | 2.9 | Reproduction | N/A | Endpoint not reported |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***1409*** | ***brook trout*** | ***Early life*** | ***7.6*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***1411*** | ***brook trout*** | ***Early life*** | ***0.26*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***1412*** | ***brook trout*** | ***Early life*** | ***7.6*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | 1428 | brook trout | Early life | 0.0256 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | 1429 | brook trout | Early life | 1.92 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | 2901 | brook trout | Early life | 5 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 2905 | brook trout | Early life | 5 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | 3020 | chinook salmon | Early life | 11.6 | Mortality | LD 53 | |
| Fish | x | x | | 3021 | chinook salmon | Early life | 21.7 | Mortality | LD 55 | |
| Fish | x | x | | 3022 | Coho salmon | Early life | 113 | Mortality | LD 85 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3023*** | ***chinook salmon*** | ***Early life*** | ***12.3*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3024*** | ***chinook salmon*** | ***Early life*** | ***2.2*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | 3025 | Coho salmon | Early life | 16.6 | Mortality | NOEC | No effect values in study |
| Fish | x | | | 3026 | lake trout | Early life | 2.93 | Physiological | ED 100 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3027*** | ***lake trout*** | ***Early life*** | ***2.95*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | | | 3028 | lake trout | Early life | 2.95 | Physiological | LOEC | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3029*** | ***lake trout*** | ***Early life*** | ***2.67*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | | | 3030 | lake trout | Early life | 2.67 | Physiological | NOEC | |
| Fish | x | x | | 3193 | Coho salmon | Early life | 56.1 | Mortality | LD 50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3973*** | ***brook trout*** | ***Early life*** | ***3.9*** | ***Behavior*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3974*** | ***brook trout*** | ***Early life*** | ***27.8*** | ***Behavior*** | ***LOEC*** | |
| Fish | x | x | | 5073 | Atlantic Salmon | Early life | 5 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 5518 | Coho salmon | Early life | 95 | Mortality | LD 50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5530*** | ***lake trout*** | ***Early life*** | ***2.93*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5531*** | ***lake trout*** | ***Early life*** | ***2.95*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA99 | Cutthroat trout | Early life | 0.567 | Survival | ED 30 | |
| Fish | x | x | | JA62 | Coho salmon | Early life | 113 | Survival | ED 85 | |
| Fish | x | x | | JA62 | Coho salmon | Early life | 16.6 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA269 | Rainbow trout | Early life | 4.67 | Survival, growth | NOEC | No effect values in study |
| Fish | x | x | | JA99 | Rainbow trout | Early life | 1.14 - 1.42 | Survival | ED 90 | |
| Fish | x | x | | JA99 | Rainbow trout | Early life | 0.064 - 0.178 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA62 | Chinook salmon | Early life | 21.7 | Survival | ED 55 | |
| Fish | x | x | | JA62 | Chinook salmon | Early life | 12.1 - 16.9 | Survival | ED 94 | |
| Fish | x | x | | JA62 | Chinook salmon | Early life | 11.4 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA62 | Chinook salmon | Early life | 11.6 | Survival | ED 53 | |
| Fish | x | x | | JA62 | Chinook salmon | Early life | 2.2 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA267 | Brook trout | Early life | 1.92 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA267 | Brook trout | Early life | 25.6 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA99 | Brook trout | Early life | 0.464 - 0.485 | Survival | ED 70-90 | |
| Fish | x | x | | JA476 | Brook trout | Early life | 0.008 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA476 | Brook trout | Early life | 0.009 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA265 | Brook trout | Early life | 2.8 - 7.6 | Survival, growth | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA64*** | ***Lake trout*** | ***Early life*** | ***2.93*** | ***Survival*** | ***LOEC*** | |
| Fish | x | x | | JA370 | Goldfish | Adult | 400 | Survival | ED >80 | |
| Fish | x | x | | JA370 | Goldfish | Adult | 200 | Survival | ED >20 | |
| Fish | x | x | | JA370 | Goldfish | Adult | 130 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA94 | Golden shiner | Early life | 3.6 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA94 | Golden shiner | Early life | 0.025 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA218, 219 | Fathead minnow | Early life | 57 | Survival | ED 25 | |
| Fish | x | x | | JA218, 219 | Fathead minnow | Early life | 160 | Survival | ED 50 | |
| Fish | x | x | | JA218, 219 | Fathead minnow | Early life | 40 | Survival | NOEC | No effect values in study |

**Attachment G Table 14**
**Critical Body Residues for Fish - 4,4-DDT**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | JA218, 219 | Fathead minnow | Early life | 86 | Survival | ED 26 | |
| Fish | x | x | | JA218, 219 | Fathead minnow | Early life | 209 | Survival | ED 79 | |
| Fish | x | x | | JA218, 219 | Fathead minnow | Early life | 88 - 96 | Survival | ED 100 | |
| Fish | x | x | | JA363 | Mosquito fish | Early life | 26.5 | Survival | ED 50 | |
| Fish | x | x | | JA161 | Green sunfish & pumpkins | Early life | 24 | Survival | ED 100 | |

Notes:
EDx - Effective dose to x% of the population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NA - Not available
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the DDT reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:

Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.

Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

Attachment G Table 14
Critical Body Residues for Fish - 4,4-DDT (References)
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 459 | 1971 | Hamelink et al. | T Am Fish Soc 100:207-214 |
| 460 | 1971 | Hamelink et al. | T Am Fish Soc 100:207-214 |
| 758 | 1976 | Jarvinen et al. | Report |
| 759 | 1976 | Jarvinen et al. | Report |
| 760 | 1976 | Jarvinen et al. | Report |
| 761 | 1976 | Jarvinen et al. | Report |
| 762 | 1976 | Jarvinen et al. | Report |
| 763 | 1976 | Jarvinen et al. | Report |
| 764 | 1976 | Jarvinen et al. | Report |
| 765 | 1976 | Jarvinen et al. | Report |
| 766 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 767 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 768 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 769 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 770 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 771 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 772 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 773 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 774 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 775 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 776 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 2772 | 1977 | Warlen, et al. | T Am Fish Soc 106:95-104 |
| 3374 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 3375 | 1977 | Jarvinen et al. | J Fish Res Board Can 34:2089-2103 |
| 5054 | 1974 | Metcalf. | Book |
| 5799 | 1967 | Gakstatter and Weiss. | T Am Fish Soc 96:301-307 |
| 5800 | 1967 | Gakstatter and Weiss. | T Am Fish Soc 96:301-307 |
| 5911 | 1979 | Guarino and Arnold. | Book |
| 1403 | 1968 | Macek.1968. | J Fish Res Board Can 25:1787-1796 |
| 1405 | 1968 | Macek.1968. | J Fish Res Board Can 25:1787-1796 |
| 1406 | 1968 | Macek.1968. | J Fish Res Board Can 25:1787-1796 |
| 1407 | 1968 | Macek.1968. | J Fish Res Board Can 25:1787-1796 |
| 1409 | 1968 | Macek.1968. | J Fish Res Board Can 25:1787-1796 |
| 1411 | 1968 | Macek.1968. | J Fish Res Board Can 25:1787-1796 |
| 1412 | 1968 | Macek.1968. | J Fish Res Board Can 25:1787-1796 |
| 1428 | 1970 | Macek and Korn. | J Fish Res Board Can 27:1496-1498 |
| 1429 | 1970 | Macek and Korn. | J Fish Res Board Can 27:1496-1498 |
| 2901 | 1977 | Addison and Zinck. | J Fish Res Board Can 34:119-122 |
| 2905 | 1977 | Addison and Zinck. | J Fish Res Board Can 34:119-122 |
| 3020 | 1969 | Buhler et al. | Toxicol Appl Pharm 14:535-555 |
| 3021 | 1969 | Buhler et al. | Toxicol Appl Pharm 14:535-555 |
| 3022 | 1969 | Buhler et al. | Toxicol Appl Pharm 14:535-555 |
| 3023 | 1969 | Buhler et al. | Toxicol Appl Pharm 14:535-555 |
| 3024 | 1969 | Buhler et al. | Toxicol Appl Pharm 14:535-555 |
| 3025 | 1969 | Buhler et al. | Toxicol Appl Pharm 14:535-555 |
| 3026 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| 3027 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| 3028 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| 3029 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| 3030 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| 3193 | 1993 | Cleveland et al. | Aquat Toxicol 27:265-280 |
| 3973 | 1973 | Peterson. | J Fish Res Board Can 30:1091-1097 |

**Attachment G Table 14**
**Critical Body Residues for Fish - 4,4-DDT (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 3974 | 1973 | Peterson. | J Fish Res Board Can 30:1091-1097 |
| 5073 | 1976 | Addison et al. | J Fish Res Board Can 33:2073-2076 |
| 5518 | 1970 | Buhler and Shanks. | J Fish Res Board Can 27:347-358 |
| 5530 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| 5531 | 1964 | Burdick et al. | T Am Fish Soc 93:127-136 |
| JA99 | 1967 | Cuerrier JP, Keith JA, Stone E. | Naturaliste Can 94:315–320. |
| JA62 | 1969 | Benoit DA, Leonard EN, Christensen GM, Fiandt JT. | Trans Am Fish Soc 105:550–560. |
| JA269 | 1970 | Macek KJ, Rodgers CR, Stalling DL, Korn S. | Trans Am Fish Soc 99:689–695. |
| JA267 | 1970 | Macek KJ, Korn S. | J Fish Res Board Can 27:1496–1498. |
| JA476 | 1996 | Wang JS, Simpson KL. | Bull Environ Contam Toxicol 56:888–895. |
| JA265 | 1968 | Macek KJ. | J Fish Res Board Can 25:1787–1796. |
| JA64 | 1964 | Burdick GE, Harris EJ, Dean HJ, Walker TM, Skea J, Colby D. | Trans Am Fish Soc 93:127–136. |
| JA370 | 1984 | Rhead MM, Perkins JM. | Water Res 18:719–725. |
| JA94 | 1971 | Courtney CH, Reed JK. | 25th Annual Conference, Southeastern Association of Game and Fish Commissioners. 17–20 Oct 1971; Charleston SC. Frankfort KY: |
| JA218 | 1976 | Jarvinen AW, Hoffman MJ, Thorslund TW. | Duluth MN: U.S. Environmental Protection Agency. EPA-600/3-76/114. |
| JA219 | 1977 | Jarvinen AW, Hoffman MJ, Thorslund TW. | J Fish Res Board Can 34:2089–2103. |
| JA363 | 1977 | Pillai MKK, Agarwal HC, Yadav DV. | Indian J Exp Biol 15:40–41. |
| JA161 | 1971 | Hamelink JL, Waybrant RC, Ball RC. | Trans Am Fish Soc 100:207–214. |

**Attachment G Table 15**
**Critical Body Residues for Fish - Aldrin**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | 5053 | Mosquito fish | Not reported | 0.157 | Mortality | NOEC | Lifestage not reported |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5072*** | ***Atlantic Salmon*** | ***Early life*** | ***5*** | ***Growth*** | ***LOEC*** | |

Notes:
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the Aldrin reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 15**
**Critical Body Residues for Fish - Aldrin (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 5053 | 1974 | Metcalf. | Book |
| 5072 | 1976 | Addison et al. | J Fish Res Board Can 33:2073-2076 |

**Attachment G Table 16**
**Critical Body Residues for Fish - Dieldrin**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | 3606 | Sheepshead minnow | Early life | 52.9 | Mortality | ED 50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3609*** | ***Sheepshead minnow*** | ***Early life*** | ***34*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3613*** | ***Sheepshead minnow*** | ***Early life*** | ***12.8*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | 5055 | Mosquito fish | Not reported | 28 | Mortality | NOEC | Lifestage not reported |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5801*** | ***Bluegill*** | ***Early life*** | ***3.7*** | ***Behavior*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5802*** | ***goldfish*** | ***Early life*** | ***3.8*** | ***Behavior*** | ***LOEC*** | |
| Fish | | x | | 5912 | Picked dogfish | Not reported | 1 | Mortality | NOEC | Lifestage not reported |
| Fish | x | x | | 14643 | largemouth bass | Adult | 1.05 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***14644*** | ***largemouth bass*** | ***Adult*** | ***1.05*** | ***Reproduction*** | ***ED 80*** | |
| Fish | x | x | | 14645 | largemouth bass | Adult | 1.05 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***14646*** | ***largemouth bass*** | ***Adult*** | ***1.05*** | ***Reproduction*** | ***ED 48*** | |
| Fish | x | x | | 14647 | largemouth bass | Adult | 0.26 | Reproduction | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***14648*** | ***largemouth bass*** | ***Adult*** | ***0.26*** | ***Reproduction*** | ***ED 67*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***14649*** | ***largemouth bass*** | ***Adult*** | ***0.26*** | ***Reproduction*** | ***ED 84*** | |
| Fish | x | x | | 2361 | rainbow trout | Early life | 0.1096 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | JA406 | rainbow trout | Early life | 5.65 | Survival | ED <50 | |
| Fish | x | x | | JA406 | rainbow trout | Early life | 0.548 | Survival | NOEC | |
| Fish | x | x | | JA269 | rainbow trout | Early life | 2.13 | Survival, growth | NOEC | |
| Fish | x | x | | JA406 | rainbow trout | Early life | 1.4 | Growth | NOEC | |
| Fish | x | x | | JA406 | rainbow trout | Early life | 0.36 | Growth | NOEC | |
| Fish | | x | | JA411 | winter flounder | Early life | 1.21-1.74 | Survival | ED 98-100 | |

Notes:
EDx - Effective dose to x% of the population
LOEC - Lowest observed effect concentration
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the Dieldrin reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.
Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 16**
**Critical Body Residues for Fish - Dieldrin (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 3606 | 1974 | Parrish et al. | Proc 27th SEAFWA 27:427-434 |
| 3609 | 1974 | Parrish et al. | Proc 27th SEAFWA 27:427-435 |
| 3613 | 1974 | Parrish et al. | Proc 27th SEAFWA 27:427-436 |
| 5055 | 1974 | Metcalf | Book |
| 5801 | 1967 | Gakstatter and Weiss | T Am Fish Soc 96:301-307 |
| 5802 | 1967 | Gakstatter and Weiss | T Am Fish Soc 96:301-307 |
| 5912 | 1979 | Guarino and Arnold | Book |
| 14643 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14644 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14645 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14646 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14647 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14648 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 14649 | 2007 | Johnson et al. | Environ Toxicol Chem 26:927-934 |
| 2361 | 1986 | Shubat and Curtis | Environ Toxicol Chem 5:69-77 |
| JA406 | 1986 | Shubat PJ, Curtis LR. | Environ Toxicol Chem 5:69–77. |
| JA269 | 1970 | Macek KJ, Rodgers CR, Stalling DL, Korn S | Trans Am Fish Soc 99:689–695. |
| JA411 | 1973 | Smith RM, Cole CF. | J Fish Res Board Can 30:1894–1898. |

**Attachment G Table 17**
**Critical Body Residues for Fish - Endrin**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***207*** | ***black bullhead*** | ***Adult*** | ***1.6*** | ***Mortality*** | ***LD 50*** | |
| ***Fish*** | ***x*** | ***x*** | ***x - no LOECs*** | ***208*** | ***black bullhead*** | ***Adult*** | ***2.2*** | ***Mortality*** | ***LD 50*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***247*** | ***largemouth bass*** | ***Early life*** | ***0.012*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | 392 | channel catfish | Early life | 1 | Mortality | LD 100 | |
| Fish | x | x | | 393 | channel catfish | Early life | 0.307 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 394 | channel catfish | Early life | 0.41 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | 395 | channel catfish | Early life | 0.307 | Survival | NOEC | No effect values in study |
| Fish | x | x | | 552 | Sheepshead minnow | Early life | 0.06 | Mortality | LD 50 | |
| Fish | x | x | | 553 | Sheepshead minnow | Early life | 0.88 | Mortality | LD 85 | |
| Fish | x | x | | 554 | Sheepshead minnow | Early life | 0.29 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | 778 | fathead Minnow | Early life | 0.64 | Mortality | LD 70 | |
| Fish | x | x | | 779 | fathead Minnow | Early life | 0.77 | Mortality | LD 70 | |
| Fish | x | x | | 780 | fathead Minnow | Early life | 0.24 | Mortality | LD 78 | |
| Fish | x | x | | 781 | fathead Minnow | Early life | 0.96 | Mortality | LD 85 | |
| Fish | x | x | | 782 | fathead Minnow | Early life | 1.15 | Mortality | LD 85 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***783*** | ***fathead Minnow*** | ***Early life*** | ***0.24*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | 784 | fathead Minnow | Early life | 0.87 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 785 | fathead Minnow | Early life | 0.67 | Reproduction | NOEC | No effect values in study |
| Fish | x | x | | 800 | Bluegill | Early life | 0.3 | Mortality | LOEC | Lifestage not reported |
| Fish | x | x | | 804 | Bluegill | Early life | 0.08 | Mortality | NOEC | Lifestage not reported |
| Fish | x | x | | 3477 | fathead Minnow | Early life | 1.1 | Mortality | NA | Endpoint not reported |
| Fish | x | x | | 3478 | fathead Minnow | Early life | 1.6 | Mortality | NA | Endpoint not reported |
| Fish | x | x | | 3479 | fathead Minnow | Early life | 0.05 | Reproduction | NA | Endpoint not reported |
| Fish | x | x | | 3480 | fathead Minnow | Early life | 0.34 | Reproduction | NA | Endpoint not reported |
| Fish | x | x | | 3481 | fathead Minnow | Early life | 0.5 | Reproduction | NA | Endpoint not reported |
| Fish | x | x | | 3531 | channel catfish | Early life | 1 | Mortality | ED 100 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3532*** | ***channel catfish*** | ***Early life*** | ***1*** | ***Behavior*** | ***LOEC*** | |
| Fish | x | x | | 3533 | channel catfish | Early life | 0.307 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 3534 | channel catfish | Early life | 0.307 | Mortality | NOEC | No effect values in study |
| Fish | x | x | | 3535 | channel catfish | Early life | 0.41 | Mortality | NOEC | No effect values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3536*** | ***Sheepshead minnow*** | ***Early life*** | ***0.29*** | ***Development*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3537*** | ***Sheepshead minnow*** | ***Early life*** | ***0.88*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3538*** | ***Sheepshead minnow*** | ***Early life*** | ***0.94*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3539*** | ***Sheepshead minnow*** | ***Early life*** | ***0.94*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | | 3540 | Sheepshead minnow | Early life | 0.94 | Growth | NA | Endpoint not reported |
| Fish | x | x | | 3541 | Sheepshead minnow | Early life | 0.94 | Mortality | NA | Endpoint not reported |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3542*** | ***Sheepshead minnow*** | ***Early life*** | ***0.29*** | ***Development*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3543*** | ***Sheepshead minnow*** | ***Early life*** | ***0.29*** | ***Development*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3544*** | ***Sheepshead minnow*** | ***Early life*** | ***0.11*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3545*** | ***Sheepshead minnow*** | ***Early life*** | ***0.26*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3546*** | ***Sheepshead minnow*** | ***Early life*** | ***1.8*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***3547*** | ***Sheepshead minnow*** | ***Early life*** | ***0.26*** | ***Reproduction*** | ***NOEC*** | |
| Fish | x | x | | 3615 | Sheepshead minnow | Early life | 1.5 | Mortality | ED 20 | |
| Fish | x | x | | 3621 | Sailfin molly | Early life | 1.7 | Mortality | ED 47 | |
| Fish | x | x | | 3628 | Sailfin molly | Early life | 0.26 | Mortality | NOEC | |
| Fish | x | x | | 3629 | Sheepshead minnow | Early life | 0.3 | Mortality | NOEC | |
| Fish | x | x | | 4912 | Golden Shiner | Early life | 0.97 | Mortality | LD 100 | |
| Fish | x | x | | 4913 | Golden Shiner | Early life | 35.4 | Mortality | LD 80 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***4914*** | ***Golden Shiner*** | ***Early life*** | ***0.21*** | ***Behavior*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***4918*** | ***Golden Shiner*** | ***Early life*** | ***0.24*** | ***Behavior*** | ***NOEC*** | |
| Fish | x | x | | 5060 | Mosquito fish | Early life | 3.4 | Behavior | LOEC | Lifestage not reported |
| Fish | x | x | | 5061 | Mosquito fish | Early life | 3.4 | Mortality | LOEC | Lifestage not reported |
| Fish | x | x | | 5885 | rainbow trout | Early life | 0.22 | Growth | ED 50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5887*** | ***rainbow trout*** | ***Early life*** | ***0.12*** | ***Behavior*** | ***LOEC*** | |
| Fish | x | | | 5889 | rainbow trout | Early life | 0.00025 | Biochemical | LOEC | Effect not relevant |
| Fish | x | | | 5891 | rainbow trout | Early life | 0.019 | Physiological | LOEC | Effect not relevant |
| Fish | x | | | 5892 | rainbow trout | Early life | 0.22 | Physiological | LOEC | Effect not relevant |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***5895*** | ***rainbow trout*** | ***Early life*** | ***0.019*** | ***Behavior*** | ***NOEC*** | |
| Fish | x | x | | 5897 | rainbow trout | Early life | 0.12 | Growth | NOEC | No effect values in study |
| Fish | x | x | | 5899 | rainbow trout | Early life | 0.22 | Mortality | NOEC | No effect values in study |
| Fish | x | | | 5901 | rainbow trout | Early life | 0.00025 | Physiological | NOEC | Effect not relevant |
| Fish | x | | | 5903 | rainbow trout | Early life | 0.12 | Physiological | NOEC | Effect not relevant |
| Fish | x | x | | JA262 | Golden Shiner | Early life | 55 | Survival | ED 80 | |
| Fish | x | x | | JA262 | Golden Shiner | Early life | 15.3 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA262 | Golden Shiner | Early life | 1.66 | Survival | ED 100 | |
| Fish | x | x | | JA262 | Golden Shiner | Early life | 1.2 | Survival | ED 75 | |
| Fish | x | x | | JA262 | Golden Shiner | Early life | 0.4 | Survival | NOEC | No effect values in study |
| Fish | x | x | | JA104 | fathead Minnow | Early life | 4.3 | Survival | NOEC | No effects values in study |
| Fish | x | x | | JA15 | channel catfish | Early life | 0.31 | Survival, Growth | NOEC | No effects values in study |
| Fish | x | x | | JA15 | channel catfish | Early life | 0.7-1.0 | Survival | ED 100 | |
| Fish | x | x | | JA15 | channel catfish | Early life | 0.41 | Survival | NOEC | No effect values in study |

**Attachment G Table 17**
**Critical Body Residues for Fish - Endrin**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference ID | Species (Common Name) | Lifestage | Concentration (mg/kg wet | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | JA23 | Bluegill | Early life | 0.3 | Survival | LOEC | Lifestage not reported |
| Fish | x | x | | JA23 | Bluegill | Early life | 0.08 | Survival | NOEC | Lifestage not reported |
| Fish | x | x | | JA132 | largemouth bass | Early life | 0.0115 | Survival | ED 40 | |

Notes:
EDx - Effective dose to x% of the population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NA - Not available
NOEC - No observed effect concentration

The Reference Identification corresponds to references presented in the Endrin reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:

Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.

Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 17**
**Critical Body Residues for Fish - Endrin (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
| 207 | 1974 | Eaton | T Am Fish Soc 4:729-735 |
| 208 | 1974 | Eaton | T Am Fish Soc 4:729-736 |
| 247 | 1976 | Fabacher | B Environ Contam Tox 16:376-378 |
| 392 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 393 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 394 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 395 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 552 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 553 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 554 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 778 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 779 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 780 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 781 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 782 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 783 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 784 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 785 | 1978 | Jarvinen and RWTyo | Arch Environ Con Tox 7:409-421 |
| 800 | 1970 | Bennett and Jr. | Pestic Monit J 3:201-203 |
| 804 | 1970 | Bennett and Jr. | Pestic Monit J 3:201-203 |
| 3477 | 1987 | Jarvinen and RWTyo. | Arch Environ Con Tox 7:409-421 |
| 3478 | 1987 | Jarvinen and RWTyo. | Arch Environ Con Tox 7:409-421 |
| 3479 | 1987 | Jarvinen and RWTyo. | Arch Environ Con Tox 7:409-421 |
| 3480 | 1987 | Jarvinen and RWTyo. | Arch Environ Con Tox 7:409-421 |
| 3481 | 1987 | Jarvinen and RWTyo. | Arch Environ Con Tox 7:409-421 |
| 3531 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 3532 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 3533 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 3534 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 3535 | 1973 | Argyle et al. | J Fish Res Board Can 30:1743-1744 |
| 3536 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3537 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3538 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3539 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3540 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3541 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3542 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3543 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3544 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3545 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3546 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3547 | 1977 | Hansen et al. | J Toxicol Environ Health 3:721-733 |
| 3615 | 1974 | Schimmel et al. | Proc 27th SEAFWA 28:187-194 |
| 3621 | 1974 | Schimmel et al. | Proc 27th SEAFWA 28:187-194 |
| 3628 | 1974 | Schimmel et al. | Proc 27th SEAFWA 28:187-194 |
| 3629 | 1974 | Schimmel et al. | Proc 27th SEAFWA 28:187-194 |
| 4912 | 1968 | Ludke et al. | T Am Fish Soc 97:260-263 |

# Attachment G Table 17
## Critical Body Residues for Fish - Endrin (References)
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| Reference ID | Year | Author | Journal |
|---|---|---|---|
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**Attachment G Table 18**
**Critical Body Residues for Fish - 2,3,7,8-TCDD**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish | x | x | | JA4 | Fathead minnow | Early life | 1.40E-02 | Mortality | LC50 | |
| Fish | x | x | | JA397 | Japanese medaka | Early life | 2.41E+00 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | JA426 | Trout - Lake | Early life | <0.000015 | Mortality | NOEC | No effects values in study |
| Fish | x | x | x | JA471 | Trout - Rainbow | Early life | 0.000291 (a) | Mortality | LOEC | |
| Fish | x | x | x | JA471 | Trout - Rainbow | Early life | 0.000279 | Mortality | LOEC | |
| Fish | x | x | x | JA471 | Trout - Rainbow | Early life | 0.000194 (a) | Mortality | NOEC | |
| Fish | x | x | x | JA471 | Trout - Lake | Early life | 0.000044 (a) | Mortality | LOEC | |
| Fish | x | x | x | JA471 | Trout - Lake | Early life | 0.000033 (a) | Mortality | NOEC | |
| Fish | x | x | | JA472 | Trout - Rainbow | Early life | 0.00023-0.00049 (a) | Mortality | LC50 | |
| Fish | x | x | | JA472 | Trout - Rainbow | Early life | 0.00023-0.00049 (a) | Mortality | LC50 | |
| Fish | x | x | x | JA473 | Trout - Brook | Early life | 0.185 | Mortality | LOEC | |
| Fish | x | x | | JA473 | Trout - Brook | Early life | 2.33E-01 | Mortality | LC50 | |
| Fish | x | x | x | JA473 | Trout - Brook | Early life | 0.337 - 0.470 | Mortality | LOEC | |
| Fish | x | x | x | JA473 | Trout - Brook | Early life | 0.135 | Mortality | NOEC | |
| Fish | x | x | x | JA473 | Trout - Brook | Early life | 0.185 | Mortality | LOEC | |
| Fish | x | x | | JA473 | Trout - Brook | Early life | 2.33E-01 | Mortality | LC50 | |
| Fish | x | x | x | JA473 | Trout - Brook | Early life | 0.337 - 0.470 | Mortality | LOEC | |
| Fish | x | x | x | JA473 | Trout - Brook | Early life | 0.135 | Mortality | NOEC | |
| Fish | x | x | x | JA185 | Trout - Rainbow | Early life | 1.38 | Behavior | LOEC | |
| Fish | x | x | x | JA185 | Trout - Rainbow | Early life | 1.38 | Growth | LOEC | |
| Fish | x | x | x | JA185 | Trout - Rainbow | Early life | 1.38 | Mortality | LOEC | |
| Fish | x | x | x | JA185 | Trout - Rainbow | Early life | 0.0016 | Behavior | NOEC | |
| Fish | x | x | x | JA185 | Trout - Rainbow | Early life | 0.0016 | Growth | NOEC | |
| Fish | x | x | x | JA185 | Trout - Rainbow | Early life | 0.0016 | Mortality | NOEC | |
| Fish | x | x | x - no LOECs | JA216 | Mosquito fish | Adult | 6.70E-03 | Mortality | LD100 | |
| Fish | x | x | | JA217 | Catfish-Channel | Early life | 1.90E-01 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | JA217 | Mosquito fish | NS | 9.00E-01 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | JA217 | Catfish-Channel | Adult | 1.40E-01 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | JA217 | Mosquito fish | Adult | 4.40E-01 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | JA236 | Trout - Rainbow | Early life | 2.50E-01 | Growth | NOEC | No effects values in study |
| Fish | x | x | | JA236 | Trout - Rainbow | Early life | 2.50E-04 | Growth | NOEC | No effects values in study |
| Fish | x | x | | JA236 | Trout - Rainbow | Early life | 2.50E-04 | Mortality | NOEC | No effects values in study |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 4.52E-03 | Mortality | ED50 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 3.00E-05 | Growth | ED13 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 5.00E-05 | Growth | ED13 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 4.10E-04 | Growth | ED20 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 8.70E-04 | Growth | ED26 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 3.00E-05 | Growth | ED27 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 1.10E-04 | Growth | ED51 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 6.80E-04 | Mortality | LD29 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 1.40E-04 | Mortality | LD33 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 1.42E-03 | Mortality | LD43 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 1.40E-04 | Mortality | LD47 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 8.70E-04 | Mortality | LD71 | |
| Fish | x | x | | JA296 | Trout - Rainbow | Early life | 8.60E-04 | Mortality | LD73 | |
| Fish | x | x | | JA304 | Salmon-coho | Early life | 4.78E-03 | Growth | ED60 | |
| Fish | x | x | | JA304 | Salmon-coho | Early life | 4.78E-03 | Growth | ED65 | |
| Fish | x | x | | JA304 | Salmon-coho | Early life | 2.17E+00 | Growth | ED84 | |
| Fish | x | x | | JA304 | Salmon-coho | Early life | 2.17E+00 | Growth | ED93 | |
| Fish | x | x | | JA304 | Salmon-coho | Early life | 4.78E-03 | Mortality | LD15 | |
| Fish | x | x | | JA304 | Salmon-coho | Early life | 4.78E-03 | Mortality | LD16 | |
| Fish | x | x | | JA304 | Salmon-coho | Early life | 2.17E+00 | Mortality | LD46 | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.0021 | Growth | NOEC | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.0021 | Mortality | NOEC | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.0022 | Behavior | LOEC | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.00217 | Growth | LOEC | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.00217 | Mortality | LOEC | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.000125 | Behavior | NOEC | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.000125 | Growth | NOEC | |
| Fish | x | x | x | JA304 | Salmon-coho | Early life | 0.000125 | Mortality | NOEC | |
| Fish | x | x | | JA368 | Mummichog | Early life | 2.00E-03 | Development | ED50 | |
| Fish | x | x | | JA368 | Killfish | Early life | 2.00E-03 | Development | ED50 | |
| Fish | x | x | | JA368 | Mummichog | Early life | 6.80E-03 | Mortality | LD100 | |
| Fish | x | x | | JA368 | Killfish | Early life | 6.80E-03 | Mortality | LD100 | |
| Fish | x | x | | JA368 | Mummichog | Early life | 2.25E-03 | Mortality | LD75 | |
| Fish | x | x | | JA368 | Killfish | Early life | 2.25E-03 | Mortality | LD75 | |
| Fish | x | x | x | JA368 | Mummichog | Early life | 0.000635 | Development | LOEC | |
| Fish | x | x | x | JA368 | Killfish | Early life | 0.000635 | Development | LOEC | |
| Fish | x | x | x | JA368 | Mummichog | Early life | 0.000635 | Mortality | LOEC | |
| Fish | x | x | x | JA368 | Killfish | Early life | 0.000635 | Mortality | LOEC | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-05 | Mortality | LD02 | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-05 | Mortality | LD02 | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-05 | Mortality | LD03 | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-05 | Mortality | LD05 | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-03 | Mortality | LD09 | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-03 | Mortality | LD100 | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-03 | Mortality | LD31 | |
| Fish | x | x | | JA426 | Trout -Lake | Early life | 4.00E-03 | Mortality | LD45 | |
| Fish | x | x | | JA470 | Trout -Lake | Early life | 1.19E-04 | Mortality | LD100 | |
| Fish | x | x | | JA470 | Trout -Lake | Early life | 1.45E-04 | Mortality | LD100 | |
| Fish | x | x | | JA470 | Trout -Lake | Early life | 1.54E-04 | Mortality | LD100 | |
| Fish | x | x | | JA470 | Trout -Lake | Early life | 5.80E-05 | Mortality | LD50 | |
| Fish | x | x | | JA470 | Trout -Lake | Early life | 6.90E-05 | Mortality | LD50 | |
| Fish | x | x | | JA470 | Trout -Lake | Early life | 8.00E-05 | Mortality | LD50 | |

**Attachment G Table 18**
**Critical Body Residues for Fish - 2,3,7,8-TCDD**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Group | Included Species | Included Effect | Included Endpoint | Reference Identification | Species (Common Name) | Lifestage | Concentration (mg/kg wet weight) | Effect | Endpoint | Value Excluded |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA470*** | ***Trout -Lake*** | ***Early life*** | ***0.00004*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA470*** | ***Trout -Lake*** | ***Early life*** | ***0.00005*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA470*** | ***Trout -Lake*** | ***Early life*** | ***0.000055*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA470*** | ***Trout -Lake*** | ***Early life*** | ***0.000023*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA470*** | ***Trout -Lake*** | ***Early life*** | ***0.000034*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA470*** | ***Trout -Lake*** | ***Early life*** | ***0.000044*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 6.50E-04 | Mortality | LD50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA474*** | ***Trout -Lake*** | ***Early life*** | ***0.000055*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA474*** | ***Trout -Lake*** | ***Early life*** | ***0.000226*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA474*** | ***Trout -Lake*** | ***Early life*** | ***0.000055*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 3.40E-05 | Mortality | LD50 | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 5.50E-05 | Mortality | LD50 | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 1.21E-04 | Mortality | LD50 | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 3.02E-04 | Mortality | LD50 | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 1.21E-04 | Mortality | LD50 | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 2.26E-04 | Mortality | LD50 | |
| Fish | x | x | | JA474 | Trout -Lake | Early life | 3.02E-04 | Mortality | LD50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA474*** | ***Trout -Lake*** | ***Early life*** | ***0.000034*** | ***Growth*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA474*** | ***Trout -Lake*** | ***Early life*** | ***0.000034*** | ***Mortality*** | ***NOEC*** | |
| Fish | x | x | | JA496 | Trout -Lake | Early life | 8.50E-05 | Mortality | LD50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA496*** | ***Trout - Lake*** | ***Early life*** | ***0.11*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA496 | Trout - Lake | Early life | 7.20E-02 | Mortality | LC20 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA496*** | ***Trout - Lake*** | ***Early life*** | ***0.043*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA496*** | ***Trout - Lake*** | ***Early life*** | ***0.11*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA496 | Trout - Lake | Early life | 7.20E-02 | Mortality | LC20 | |
| Fish | x | x | | JA91 | Common carp | Early life | 2.22E+00 | Mortality | LD37 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA91*** | ***Trout - Lake*** | ***Early life*** | ***0.226*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | JA91 | Trout - Lake | Early life | 6.50E-02 | Mortality | LC50 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA91*** | ***Trout - Lake*** | ***Early life*** | ***0.055*** | ***Mortality*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA91*** | ***Trout - Lake*** | ***Early life*** | ***0.034*** | ***Mortality*** | ***NOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***JA91*** | ***Carp*** | ***Early life*** | ***2.2*** | ***Mortality*** | ***LOEC*** | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 2.26E-02 | Mortality | LD50 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 1.00E-03 | Mortality | LD50 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 3.30E-02 | Mortality | LD100 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 1.30E-02 | Mortality | LD83 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 9.00E-03 | Mortality | LD100 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 5.00E-03 | Mortality | LD20 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 3.30E-02 | Mortality | LD40 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 1.30E-02 | Mortality | LD25 | |
| Fish | | x | | NewFields09-11 | Flatfish | Early life | 9.00E-03 | Mortality | LD12 | |
| Fish | x | x | | SEQ99_13 | Lake Whitefish | Early life | 8.50E-02 | Growth | NA | |
| Fish | x | x | | SEQ99_13 | Trout - Rainbow | Early life | 1.50E-01 | Growth | NA | |
| Fish | x | x | | URS144 | Yellow perch | Early life | 1.43E-04 | Growth | NOEC | No effects values in study |
| Fish | x | x | | URS144 | Yellow perch | Early life | 1.43E-04 | Mortality | NOEC | No effects values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS212*** | ***Trout - Brook*** | ***Early life*** | ***0.0012*** | ***Reproduction*** | ***LOEC*** | |
| Fish | x | x | | URS212 | Trout - Brook | Early life | 1.20E-03 | Growth | NOEC | No effects values in study |
| Fish | x | x | | URS212 | Trout - Brook | Early life | 1.20E-03 | Mortality | NOEC | No effects values in study |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS212*** | ***Trout - Brook*** | ***Early life*** | ***0.0006*** | ***Reproduction*** | ***NOEC*** | |
| Fish | x | x | | URS239 | Catfish-Channel | Early life | 4.40E-03 | Mortality | LD100 | |
| Fish | x | x | | URS239 | Mosquito fish | Early life | 7.20E-03 | Mortality | LD100 | |
| Fish | x | x | | URS34 | Trout - Rainbow | Early life | 2.58E-03 | Development | ED130 | |
| Fish | x | x | | URS34 | Trout - Rainbow | Early life | 2.58E-03 | Growth | ED130 | |
| Fish | x | x | | URS34 | Trout - Rainbow | Early life | 2.58E-03 | Growth | ED136 | |
| Fish | x | x | | URS34 | Trout - Rainbow | Early life | 2.58E-03 | Growth | ED186 | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS34*** | ***Trout - Rainbow*** | ***Early life*** | ***0.00065*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS34*** | ***Trout - Rainbow*** | ***Early life*** | ***0.00065*** | ***Growth*** | ***LOEC*** | |
| ***Fish*** | ***x*** | ***x*** | ***x*** | ***URS34*** | ***Trout - Rainbow*** | ***Early life*** | ***0.00065*** | ***Mortality*** | ***LOEC*** | |
| Fish | x | x | | URS96 | Trout -Lake | Early life | 4.40E-05 | Mortality | LD50 | |

Notes:
EDx - Dose that is effective to x% of population
LCx - Concentration that is lethal to x% of population
LDx - Dose that is lethal to x% of population
LOEC - Lowest observed effect concentration
NA - Not available
NOEC - No observed effect concentration

(a) Concentration was not measured.

The Reference Identification corresponds to references presented in the 2,3,7,8-TCDD reference table.
Data in italics and boldface were selected for use in the risk assessment.
Only whole body residues are presented.
Source databases:
Environmental Residue Effects Database (ERED; https://ered.el.erdc.dren.mil/). Accessed December 5, 2017.
Jarvinen, A.W., and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, pp. 1-358.

Tissue residue selection process:
1 - Select only whole body residues.
2 - Identify freshwater fish species.
3 - Identify Behavior, Development, Reproduction, Growth, and Survival/Mortality effects.
4 - Identify NOEC values with no associated effects values and exclude NOECs.
5 - Identify range of acceptable NOEC and LOEC results for fish and five effects.
Alternative effects levels (e.g., LC50) only presented if no acceptable NOECs or LOECs are identified.

**Attachment G Table 18**
**Critical Body Residues for Fish - 2,3,7,8-TCDD (References)**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Reference ID | Year | Author | Journal |
|---|---|---|---|
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| JA91 | 1991 | Cook, PM, DW Kuehl, MK Walker, RE Peterson | Banbury Report 35: Biological Basis for Risk Assessment of Dioxins and Related Compounds |
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| URS144 | 1986 | Kleeman JM, JR Olson, SM Chen, RE Peterson | Toxicol Appl Pharmacol 083:402-411. |
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| JA397 | 1995 | Schmieder P, Lothenbach D, Tietge J, Erickson R, Johnson R | Environ Tox and Chem 14: 1735-1748 |
| JA471 | 1992 | Walker MK, Hufnagle Jr LC, Clayton MK, Peterson RE | Aquat Toxicol 22:15-37 |
| JA472 | 1991 | Walker MK, Peterson RE | Aquat Toxicol 21:3-4 |
| JA473 | 1994 | Walker MK, Peterson RE | Environ Toxicol Chem 13:817–820 |

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# Attachment H

# Derivation of Wildlife Toxicity Reference Values

# 1.0 Introduction

The ecotoxicity values utilized in this risk assessment, referred to herein as toxicity reference values (TRVs), represent conservative thresholds for ecological effects. TRVs can be defined as the daily dose of a constituent that is considered protective of wildlife (mammals and birds) populations or individuals. The dose is expressed in milligram per kilogram body weight per day ($mg/kg_{bw}/day$) and can be based on either a no observed adverse effects level (NOAEL) or a lowest observed adverse effects level (LOAEL).

TRVs incorporated into the quantitative evaluation of potential ecological risks to wildlife were obtained primarily from two sources: the current USEPA Ecological Soil Screening Level (Eco-SSL) documents (www.epa.gov/ecotox/ecossl/) (USEPA, 2007a) and Oak Ridge National Laboratory's (ORNL) publication *Toxicological Benchmarks for Wildlife: 1996 Revision* (Sample et al., 1996). When TRVs were not derived in these documents, the literature was reviewed for relevant data and TRVs were derived using the methodology of ORNL (Sample et al., 1996).

USEPA guidance (USEPA, 1997) specifies that it is preferred that TRVs represent a NOAEL for chronic exposure to site-related constituents. Should a NOAEL not be available, USEPA guidance allows the use of the lowest exposure level shown to produce adverse effects (i.e., the LOAEL) in the development of TRVs. Both upper and lower bound TRVs (LOAEL-based TRVs and NOAEL-based TRVs, respectively) were developed for this assessment in order to estimate a range of potential risks to mammalian and avian receptors. The NOAEL-based TRVs represent non-hazardous exposure levels for the wildlife species evaluated, while the LOAEL-based TRVs represent potential exposure levels at which adverse effects may become evident.

NOAEL-based TRVs were preferably based on chronic NOAELs, with an emphasis on studies that measured effects on survival, reproduction, and growth endpoints applicable to the protection of wildlife populations. The following steps were followed to select LOAEL-based TRVs:

- If a LOAEL was reported for the study used to derive the NOAEL-based TRV, that LOAEL value was selected as the LOAEL-based TRV;

- In the case where the geometric mean of several NOAELs for growth and reproductive endpoints was used as the NOAEL-based TRV (i.e., EcoSSL-based TRVs), the geometric mean of the LOAELs for growth and reproduction was calculated and selected as the LOAEL-based TRV;

- For EcoSSL-based TRVs, when the NOAEL-based TRV was based on a single NOAEL and no corresponding LOAEL was available, the upper-bound LOAEL for growth and reproduction was used; and
- For TRVs derived from other sources, a factor of 4 was applied to the NOAEL-based TRV to estimate a LOAEL-based TRV when a study-specific LOAEL was not available.

The derivation of the individual TRVs are discussed in the following section.

# 2.0 Wildlife Toxicity Reference Values

The following sub-sections provide a brief overview of the constituent, as well as the derivation of the NOAEL- and LOAEL-based TRVs.

## 2.1 Arsenic

Arsenic is a naturally occurring element. The most commonly occurring form of arsenic is a gray, brittle, metalloid (Irwin et al., 1997). Arsenic is typically found in the environment in combination with other elements such as oxygen, chloride and sulfur. It is odorless and nearly tasteless (ATSDR, 2007a).

The primary use of arsenic (as arsenic trioxide) in industry is in products used for wood preservation. In 2003, US manufacturers of wood preservatives containing arsenic began a voluntary transition to other wood preservatives that do not contain arsenic in wood products for certain residential uses (ATSDR, 2007a). Arsenic is also used in the production of agricultural chemicals such as insecticides, herbicides, algaecides, and growth stimulants for plants and animals (ATSDR, 2007a). It is also used in the manufacturing of certain types of glass and in the electronics industry in the manufacture of integrated circuits, solar cells, and lasers (ATSDR, 2007a).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 1,173 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 5 contained appropriate data for avian test species and 55 contained data for mammalian test species (USEPA, 2005a). In the Eco-SSL TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the NOAEL-based TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 2.47 mg/$kg_{bw}$/day (USEPA, 2005a). However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 1.04 mg/$kg_{bw}$/day. This value corresponds to the growth NOAEL for a study with dogs. The associated LOAEL from this study was 1.66 mg/$kg_{bw}$/day and this value was selected as the LOAEL-based TRV.

For birds the geometric mean of the NOAEL values for reproduction and growth could not be calculated as only two values were available. The NOAEL-based TRV is equal to 2.24 mg/$kg_{bw}$/day which is the lowest NOAEL value for reproduction, growth, or survival. This value corresponds to the growth NOAEL for a study with chickens (USEPA, 2005a). There was no LOAEL associated with this study so the LOAEL-based TRV was based on the upper-bound LOAEL for growth and reproduction. This resulted in a LOAEL-based TRV of 17.3 mg/$kg_{bw}$/day based on growth effects on mallards.

## 2.2 Cadmium

Cadmium occurs naturally in the earth's crust and is commonly referred to as a heavy metal. Cadmium is a relatively rare, malleable, silver-white, odorless metal, which typically occurs in nature with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide) (ATSDR, 2012). The majority of cadmium in the United States is extracted as a by-product during the production of zinc, lead or copper (ATSDR, 2012 and California EPA, 1997a).

Cadmium compounds are found in many industrial processes and products, including: metal plating and battery production; pigments; stabilizing agents in polyvinyl chloride products; production of photocells and light emitting diodes; and production of automobile radiators (ATSDR, 2012).

Prolonged oral exposure of laboratory animals to cadmium has resulted in kidney damage and fragile bones that break easily. Oral exposure of experimental animals has resulted in testicular necrosis, ovarian damage, infertility, placental toxicity, embryotoxicity, fetotoxicity and teratogenicity. Evidence of developmental effects such as decreased weight gain and neurobehavioral deficits have been observed in animal studies (ATSDR, 2012 and Irwin et al., 1997).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 1,953 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 35 contained appropriate data for avian test species and 145 contained data for mammalian test species (USEPA, 2005b). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 1.86 mg/$kg_{bw}$/day (USEPA, 2005b). However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 0.77 mg/$kg_{bw/}$day. The associated LOAEL from this study was 7.7 mg/$kg_{bw}$/day and this value was selected as the LOAEL-based TRV.

For birds the geometric mean of the NOAEL values for reproduction and growth was calculated at 1.47 mg/$kg_{bw}$/day (USEPA, 2005b). This value is lower than the lowest bounded LOAEL for reproduction, growth, or survival. Therefore, the avian TRV is equal to the geometric mean of NOAEL values for reproduction and growth and is equal to 1.47 mg/$kg_{bw}$/day. The geometric mean of the LOAELs for growth and reproduction was calculated and selected as the LOAEL-based TRV. The geometric mean of these LOAELs was 6.35 mg/$kg_{bw}$/day.

## 2.3 Copper

Copper is a ductile, malleable, reddish colored metal, which occurs naturally in rock, soil, water, sediment and air. The average concentration of copper in the earth’s crust is about 50 ppm (ATSDR, 2004 and Irwin et al., 1997).

Copper is used in electrical wiring, switches, plumbing, heating, roofing and building construction, chemical and pharmaceutical machinery, electroplated coatings, piping, insecticides, catalysts, and in anti-fouling paints (ATSDR, 2004 and Irwin et al., 1997).

Prolonged exposure of laboratory animals to copper via the oral route has been reported to result in a variety of potential systemic effects including: liver and kidney damage; blood effects (decreased hemoglobin); and increase blood pressure. Increased postnatal mortality has been observed in animals exposed to copper at high levels in the diet (ATSDR, 2004). Human, plant and animal enzymes require minute amounts of copper; therefore, copper is an essential nutrient (Irwin et al., 1997). However, high concentrations of copper can be toxic to some species.

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 3,365 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 107 contained appropriate data for avian test species and 97 contained data for mammalian test species (USEPA, 2007b). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 25 mg/kg$_{bw}$/day (USEPA, 2007b). However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 5.6 mg/kg$_{bw}$/day. This value corresponds to the growth and survival NOAELs for a study with pigs. The associated LOAEL from this study was 9.34 mg/kg$_{bw}$/day and this value was selected as the LOAEL-based TRV.

For birds the geometric mean of the NOAEL values for reproduction and growth was calculated at 18.5 mg/kg$_{bw}$/day (USEPA, 2007b). However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 4.05 mg/kg$_{bw}$/day. This value corresponds to the reproduction NOAEL for a study with chickens. The associated LOAEL from this study was 12.1 mg/kg$_{bw}$/day and this value was selected as the LOAEL-based TRV.

## 2.4 Lead

Lead is a bluish-gray, noncombustible metal that occurs naturally in the earth's crust as the end-product of the radiometric decay of three naturally-occurring radioactive elements: uranium, thorium, and actinium. Lead is malleable, ductile, and resistant to chemical corrosion (ATSDR, 2007b; California EPA, 1997b).

Lead compounds are used in construction materials for tank linings, piping, equipment for handling corrosive gases and liquids used in petroleum refining. Lead is also found in a number of different products, including pigments for paints, ceramics, plastics, electronic devices, ammunition, solder, cable covering, and sheet lead. The amount of lead in these products has been reduced in recent years due to the potential for harmful effects in humans and animals. The primary use of lead today is in the manufacture of batteries for cars and other vehicles (ATSDR, 2007b; California EPA, 1997b).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 2,429 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 54 contained appropriate data for avian test species and 219 contained data for mammalian test species (USEPA, 2005c). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 40.7 mg/kg$_{bw}$/day. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 4.7 mg/kg$_{bw}$/day. This value corresponds to the NOAEL for growth from a study with rats (USEPA, 2005c). The associated LOAEL from this study was 8.9 mg/kg$_{bw}$/day and this value was selected as the LOAEL-based TRV.

For birds the geometric mean of the NOAEL values for reproduction and growth was calculated at 10.9 mg/kg$_{bw}$/day. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 1.63 mg/kg$_{bw}$/day. This value corresponds to the reproduction and growth from a study with chickens (USEPA, 2005c). The associated LOAEL from this study was 3.26 mg/kg$_{bw}$/day and this value was selected as the LOAEL-based TRV.

## 2.5 Mercury

Mercury occurs naturally in the environment. Elemental mercury is an odorless, silver white, very heavy, mobile, liquid metal, which is slightly volatile at ordinary temperatures. Solid mercury is tin-white, ductile, and malleable. Liquid mercury is commonly found in thermometers, light switches, and dental amalgams (ATSDR, 1999; California EPA, 1997c).

Mercury is a mutagen, teratogen, and carcinogen, with toxicity and environmental effects varying with the form of mercury, dose, and route of ingestion, and with the exposed organism's species, sex, age, and general condition (USEPA, 2011). Methyl mercury is the most toxic form. Inorganic mercury is methylated primarily by bacteria in both anaerobic and aerobic environments. The organic mercury compounds are more readily absorbed and poorly excreted in comparison with inorganic forms. The primary targets of acute exposures are the central nervous system and kidneys in fish, birds and mammals (USEPA, 2011).

Birds and mammals are particularly vulnerable because of the pronounced biomagnification of organomercury. There are numerous effects in birds, including delayed testicular development, altered mating behavior, reduced fertility, reduced survivability and growth in young and gonadal atresia. Neurological and reproductive effects are also common as a result of exposure of high levels of mercury (USEPA, 2011).

The mammalian TRV for methyl mercury was developed by ORNL (Sample et al., 1996) based on a chronic toxicity study with the rat (Verscheuren et al., 1976 as cited in Sample et al., 1996). Methyl mercury chloride ($CH_3HgCl$) was fed to rats in their diet at three dose levels (0.1, 0.5, and 2.5 ppm $CH_3HgCl$) over three generations (> 1 year). Potential effects on reproduction as pup viability were monitored. Significant adverse effects were not observed at 0.5 ppm $CH_3HgCl$. This dose level was therefore considered to be a chronic NOAEL and the 2.5 ppm dose was considered to be the chronic LOAEL. Based on a food consumption rate of 0.028 kg/day (calculated using the allometric equation of EPA 1988a as cited in Sample et al., 1996), an average body weight of 0.35 kg (EPA, 1988a as cited in Sample et al., 1996), and 79.89% Hg in $CH_3HgCl$, the final chronic NOAEL of 0.032 mg/$kg_{bw}$/day and final chronic LOAEL of 0.16 mg/$kg_{bw}$/day were calculated.

The avian TRV for methyl mercury was developed by ORNL (Sample et al., 1996) based on a chronic toxicity study with mallard ducks (Heinz, 1979 as cited in Sample et al., 1996). Methyl mercury dicyandiamide was fed to ducks in their diet at one concentration (0.5 ppm mercury) for three generations. Reproductive effects were evaluated. The ducks fed a diet containing 0.5 ppm methyl mercury dicyandiamide produced fewer eggs and ducklings than the control ducks. This exposure level was identified as the chronic LOAEL. The chronic NOAEL was estimated by multiplying the chronic LOAEL by an uncertainty factor of 0.1. Based on a food consumption rate of 0.128 kg/day (measured in the study), and an average body weight of 1 kg (Heinz et al. 1989 as cited in Sample et al., 1996), the final chronic NOAEL of 0.0064 mg/$kg_{bw}$/day and final chronic LOAEL of 0.064 mg/$kg_{bw}$/day were calculated.

## 2.6 Nickel

Nickel is a hard, silvery, metal found in abundance in the earth's crust. It is commonly used in industry for manufacturing corrosion-resistant alloys, electroplating, and the production of catalysts and nickel-cadmium batteries (ATSDR, 2005a).

Nickel deficiency has been induced in several species (rats, chicks, cows and goats) indicating nickel is an essential nutrient in these species. However, exposure to high levels of nickel may adversely impact animal health. All forms of nickel examined to date in laboratory animals have exhibited adverse effects on male reproductive function. Animal studies also demonstrate that nickel adversely affects spermatogenesis, litter size and pup body weight, however, no teratogenic effects have been clearly demonstrated for compounds other than nickel carbonyl. Animals exposed to high levels of nickel for prolonged periods have exhibited effects on the stomach, blood, liver, kidneys and immune system (ATSDR, 2005a).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 1,169 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 11 contained appropriate data for avian test species and 52 contained data for mammalian test species (USEPA, 2007c). In the Eco-SSL TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the NOAEL-based TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 7.7 $mg/kg_{bw}$/day (USEPA, 2007c). However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 1.7 $mg/kg_{bw}$/day. This value corresponds to the reproduction NOAEL for a study with mice. The associated LOAEL from this study was 3.4 $mg/kg_{bw}$/day and this value was selected as the LOAEL-based TRV.

For birds, the geometric mean of the NOAEL values for reproduction and growth was calculated at 6.71 $mg/kg_{bw}$/day (USEPA, 2007c). This value is lower than the lowest bounded LOAEL for reproduction, growth, or survival. Therefore, the avian NOAEL-based TRV is equal to the geometric mean of NOAEL values for reproduction and growth of 6.71 $mg/kg_{bw}$/day. The geometric mean of the LOAELs for growth and reproduction was calculated and selected as the LOAEL-based TRV. The geometric mean of these LOAELs was 18.6 $mg/kg_{bw}$/day.

## 2.7 Selenium

Selenium is a naturally occurring, solid substance, widely, but unevenly distributed in the earth's crust. It is commonly found in rocks and soil. In the environment naturally occurring selenium is usually found combined with sulfide minerals or silver, copper, lead and nickel minerals. Coal and soils surrounding volcanoes tend to have higher amounts of selenium. The amorphous form is either red in powder form, or black in vitreous form. Pure selenium, referred to as elemental selenium, takes on a black crystalline hexagonal form (the most stable form of selenium) and is a lustrous metallic gray (ATSDR, 2003; California EPA, 1997d).

Selenium is used in the glass industry as a decolorizing agent and as a pigment. It is also used in the production of electrodes for arc lights, electrical instruments, selenium photocells, semiconductor fusion mixtures, photographic emulsions, as a vulcanizing agent in the processing of rubber, in the manufacture of metal alloys, and as a trace element in animal feed. Selenium sulfides are used as pharmaceutical and veterinary drugs to topically treat eczemas and dermatomycoses. They are also used as external preparations in shampoos for dandruff and for control of sebhorrheic dermatitis and nonspecific dermatoses (ATSDR, 2003; California EPA, 1997d).

Selenium is an essential nutrient in both animals and humans. However, exposure at levels only slightly higher than essential may result in adverse impact to the health of birds, fish and wildlife. Deleterious impacts to the immune system have been observed amongst animals exposed to selenium at levels only slightly higher than believed to be essential. Consumption of high levels of selenium by pig, sheep, and cattle has been shown to interfere with normal fetal development and produce fetal malformations (ATSDR, 2003; California EPA, 1997d; Irwin et al., 1997).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 1,734 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 69 contained appropriate data for avian test species and 132 contained data for mammalian test species (USEPA, 2007d). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 0.437 mg/kg$_{bw}$/day (USEPA, 2007d). However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 0.143 mg/kg$_{bw}$/day. This value corresponds to the growth NOAEL for a study with pigs. The associated LOAEL from this study was 0.215 mg/kg$_{bw}$/day and this value was selected as the LOAEL-based TRV.

For birds, the geometric mean of the NOAEL values for reproduction and growth was calculated at 0.606 mg/kg$_{bw}$/day (USEPA, 2007d). This value is higher than the lowest bounded LOAEL for reproduction, growth, or survival. Therefore, the avian NOAEL-based TRV is equal to the highest bounded NOAEL that is lower than the lowest bounded LOAEL for reproduction, growth or survival and is equal to 0.290 mg/kg$_{bw}$/day. This value corresponds to the survival NOAEL for a study with chickens. The associated LOAEL from this study was 0.579 mg/kg$_{bw}$/day and this value was selected as the LOAEL-based TRV.

## 2.8 Silver

Silver is a rare, soft, ductile, lustrous, white metal occurring naturally in the pure form and in ores. Typical uses for silver include the manufacture of jewelry, silverware, electronic equipment, and dental fillings. Silver (metallic silver) is registered as an algaecide for use in swimming pool water systems. It is also used in ceramic water filtering systems to prevent the growth of bacteria.

Animal studies suggest that long-term exposure to high levels of silver may result in a variety of potential adverse effects, including: nervous system effects (evidenced by reduced activity levels); decreased weight gain; cardiac enlargement; vascular hypertension; hepatic necrosis; anemia; lowered immunological activity; altered membrane permeability; kidney pathology; enzyme inhibition; growth retardation; and a shortened life span. Silver and its compounds are not known to be teratogenic, nor does existing evidence indicate a strong effect of silver on reproduction. However, existing data is inadequate to arrive at a firm conclusion regarding potential reproductive effects of silver on animals (ATSDR, 1990; California EPA, 1997e; Irwin et al., 1997).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 4,009 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 7 contained appropriate data for avian test species and 13 contained data for mammalian test species (USEPA, 2006). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, there were not three NOAEL values within the growth and reproduction effect groups so a geometric mean could not be calculated. There was not at least one NOAEL for reproduction or growth. There were at least three LOAEL values within the growth and reproduction effect groups. Therefore, the mammalian TRV for silver is equal to the lowest LOAEL for reproduction or growth divided by 10 and is equal to 6.02 mg/kg$_{bw}$/day. The 60.2 mg/kg$_{bw}$/day value corresponds to the growth LOAEL for a study with pigs (USEPA, 2006). Therefore, the LOAEL- and NOAEL-based TRVs for mammals were 60.2 mg/kg$_{bw}$/day and 6.02 mg/kg$_{bw}$/day respectively.

For birds, there were not three NOAEL values within the growth and reproduction effect groups so a geometric mean could not be calculated. There was not at least one NOAEL for reproduction or growth. There were at least three LOAEL values within the growth and reproduction effect groups. Therefore, the avian TRV for silver is equal to the lowest LOAEL for reproduction or growth divided by 10 and is equal to 2.02 mg/kg$_{bw}$/day. The 20.2 mg/kg$_{bw}$/day value corresponds to the growth LOAEL for a study with turkeys (USEPA, 2006). Therefore, the LOAEL- and NOAEL-based TRVs for birds were 20.2 mg/kg$_{bw}$/day and 2.02 mg/kg$_{bw}$/day respectively.

## 2.9 Zinc

Elemental zinc is a bluish-white, lustrous metal, which becomes covered with a white coating of basic carbonate on exposure to moist air, but is stable in dry air. Zinc is the $25^{th}$ most abundant element and is widely distributed in nature, making up between 0.0005% and 0.02% of the Earth's crust. Zinc is found in air, soil, and water, and is present in all foods (California EPA, 1997f; Irwin et al., 1997).

Zinc is used most commonly as a protective coating for other metals and in alloys such as bronze and brass. Zinc is emitted to the atmosphere during mining and refining, manufacturing processes, and combustion of zinc-containing materials (California EPA, 1997f and Irwin et al., 1997). Zinc in low to moderate amounts is of very low toxicity, and in low concentrations is an essential element in plant and animal life. However, animals exposed to excess levels of zinc for long periods have exhibited evidence of copper deficiencies, affects on iron metabolism, and liver, kidney and pancreas damage (ATSDR, 2005b; Irwin et al. 1997).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 10,259 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 53 contained appropriate data for avian test species and 99 contained data for mammalian test species (USEPA, 2007e). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 75.4 $mg/kg_{bw}/day$ (USEPA, 2007e). This value is lower than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the geometric mean of NOAEL values within the reproduction and growth effect groups and is equal to 75.4 $mg/kg_{bw}/day$. The geometric mean of the LOAELs for growth and reproduction was 298 $mg/kg_{bw}/day$ and this value was selected as the LOAEL-based TRV. Individual

For birds, the geometric mean of the NOAEL values for reproduction and growth was calculated at 66.1 $mg/kg_{bw}/day$ (USEPA, 2007e). This value is lower than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the NOAEL-based TRV is equal to the geometric mean of NOAEL values within the reproduction and growth effect groups and is equal to 66.1 $mg/kg_{bw}/day$. The geometric mean of the LOAELs for growth and reproduction was 187 $mg/kg_{bw}/day$ and this value was selected as the LOAEL-based TRV.

## 2.10 DDD, DDE, DDT

DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane) was a widely used insecticide for the control of mosquito-borne malaria and insects on agricultural crops. DDE (1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene) and DDD (1,1-dichloro-2,2-bis(p-chlorophenyl)ethane) are contaminants, as well as degradation and metabolic products, of DDT. DDD was also used as a pesticide; one form of DDD (o,p'-DDD) has been used medically to treat cancer of the adrenal gland. Use of DDT on crops has generally been replaced by less persistent insecticides. DDT was used extensively during World War II amongst both military and civilian populations to control insect typhus and malaria vectors, and was then widely used as an insecticide after 1945. DDT was banned for use in Sweden in 1970 and in the United States in 1972. However, because of the extensive past use of DDT worldwide and the persistence of DDT and its metabolites, these chemicals are virtually ubiquitous and are continually being transformed and redistributed in the environment (ATSDR, 2002a).

Animal studies have shown some evidence for effects on the liver, immune system, and central nervous system from chronic oral exposure to DDT. Reproductive toxicity studies indicate that DDT impaired reproduction and/or development in mice, rats, rabbits, dogs and avian species. Specific effects on development have included increased post-implantation loss, reduced fetal weight, increased postnatal mortality, reduced postnatal weight gain, and neurobehavioral effects. Additionally, avian species exhibit eggshell thinning and embryo deaths (ATSDR, 2002a).

Based on structural similarity the TRVs developed by USEPA as part of the Eco-SSL derivation process for DDT and metabolites were selected to represent p,p-DDT, p,p-DDD and p,p-DDE in this ecological risk assessment.

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 1,149 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 105 contained appropriate data for avian test species and 73 contained data for mammalian test species (USEPA, 2007f). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 7.65 $mg/kg_{bw}/day$. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 0.147 $mg/kg_{bw}/day$. This value corresponds to the reproduction NOAEL for a study with rats (USEPA, 2007f). The associated LOAEL from this study was 0.735 $mg/kg_{bw}/day$ and this value was selected as the LOAEL-based TRV.

For birds, geometric mean of the NOAEL values for reproduction and growth was calculated at 4.66 $mg/kg_{bw}/day$. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 0.227 $mg/kg_{bw}/day$. This value corresponds to the growth NOAEL for a study with chickens (USEPA, 2007f). The associated LOAEL from this study was 2.27 $mg/kg_{bw}/day$ and this value was selected as the LOAEL-based TRV.

## 2.11 Aldrin

From the 1950s and 1970s aldrin was used extensively as an insecticide on crops. In 1970 the US Department of Agriculture canceled all uses of aldrin. However, in 1972 USEPA approved the use of aldrin in killing termites. In 1974 USEPA banned all uses of aldrin except to control termites. In 1987, the manufacturer of aldrin voluntarily canceled the registration for use in controlling termites. In the environment, aldrin quickly breaks down to form dieldrin (an organic compound also historically used as an insecticide). Experimental data from animal toxicity studies indicate that exposure to aldrin may have adverse impacts on the nervous system and kidneys, may result in increases in liver enzymes and liver weight, may decrease the effectiveness of the immune system, and may result in decreased reproductive function. Several studies have observed a variety of adverse impacts to the male reproductive system of animals exposed to aldrin (ATSDR, 2002b).

The mammalian TRV for aldrin was derived by ORNL (Sample et al., 1996) based on a chronic toxicity study with the rat (Treon and Cleveland, 1955 as cited in Sample et al., 1996). Aldrin was fed to rats in their diet at three concentrations (2.5, 12.5, and 25 ppm). Reproductive effects were monitored over three generations. Rats exposed to 12.5 ppm aldrin displayed smaller litter sizes and increased offspring mortality. No such effects were noted in animals receiving 2.5 ppm aldrin in the diet. This dietary exposure was therefore considered to be the chronic NOAEL. Assuming a food consumption rate of 0.028 kg/day (calculated using the allometric equation from EPA 1988a as cited in Sample et al., 1996) and a body weight of 0.35 kg (EPA 1998a as cited in Sample et al., 1996), the final chronic NOAEL of 0.2 $mg/kg_{bw}/day$ was calculated. A factor of 4 was applied to the NOAEL-based TRV to estimate a LOAEL-based TRV of 0.8 $mg/kg_{bw}/day$.

No appropriate study of the effects of aldrin on avian receptors was found.

## 2.12 Chlordane

Chlordane, an organochlorine compound, is a thick liquid ranging from colorless to amber; it may have no smell or a mild, irritating smell. Chlordane is a man-made substance that was used as a pesticide in the United States from 1948 to 1988. Prior to 1978, chlordane was used as a pesticide on agricultural crops, lawns, and gardens, and as a fumigating agent. From 1983 until 1988 chlordane's only approved use was to control termites in homes. USEPA canceled all uses for chlordane in 1988. Chlordane is very persistent in the environment and is known to remain in some soils for over 20 years. Chlordane does not break down rapidly in air and accumulates in fish, birds, and mammals. Experimental animals exposed to chlordane have exhibited a variety of adverse effects, including: damage to the liver and central nervous system; body weight loss; and a reduction in fertility (ATSDR, 2018).

Based on structural similarity the TRVs for Chlordane developed by ORNL were selected to represent cis-chlordane, gamma-chlordane, and trans-chlordane in this ecological risk assessment.

The mammalian TRVs for chlordane were derived by ORNL (Sample et al., 1996) based on a chronic toxicity study with the mouse (Keplinger, et al., 1968 as cited in Sample et al., 1996). Chlordane was administered to mice in their diet at three concentrations (25, 50, and 100 ppm), and reproductive effects were monitored over 6 generations. Decreased viability and reduced number of offspring were observed in the groups of mice exposed to 50 and 100 ppm chlordane in the diet. No effects were observed in the group receiving 25 ppm chlordane in the diet. This dietary exposure level was identified as the chronic NOAEL. Assuming food consumption rate of 0.0055 kg/day (calculated using allometric equation from EPA 1988a as cited in Sample et al., 1996), and a body weight of 0.03 kg (EPA 1988a as cited in Sample et al., 1996), the final chronic NOAEL of 4.6 mg/kg$_{bw}$/day was calculated. Based on the test LOAEL of 50 ppm chlordane in the diet, the LOAEL-based TRV was calculated to be 9.2 mg/kg$_{bw}$/day.

The avian TRVs for chlordane were developed by ORNL (Sample et al., 1996) based on a chronic toxicity study with the red-winged blackbird (Stickel et al., 1983 as cited in Sample et al., 1996). Chlordane was administered to blackbirds at three dietary concentrations (10, 50, and 100 ppm). Mortality was recorded after 84 days. Birds consuming 50 and 100 ppm chlordane experienced 26% and 25% mortality, respectively. No effects were observed in the group consuming 25 ppm chlordane. This dietary exposure level was identified as the chronic NOAEL. Assuming a food consumption rate of 0.0137 kg/day (calculated using the allometric equation from Nagy 1987 as cited in Sample et al., 1996) and a body weight of 0.064 kg (measured in the study), the final chronic NOAEL of 2.14 mg/kg$_{bw}$/day was calculated. Based on the test LOAEL of 50 ppm chlordane in the diet, the LOAEL-based TRV was calculated to be 10.7 mg/kg$_{bw}$/day.

## 2.13 Dieldrin

From the 1950s and 1970s dieldrin was used extensively as an insecticide on crops. In 1970 the US Department of Agriculture canceled all uses of dieldrin. However, in 1972 USEPA approved the use of dieldrin in killing termites. In 1974 USEPA banned all uses of dieldrin except to control termites. In 1987, the manufacturer of dieldrin voluntarily canceled the registration for use in controlling termites. In the environment dieldrin may be found as the breakdown product of aldrin (an organic compound also historically used as an insecticide). Experimental data from animal toxicity studies indicate that exposure to aldrin may have adverse impacts on the nervous system and kidneys, may result in increases in liver enzymes and liver weight, may decrease the effectiveness of the immune system, and may result in decreased reproductive function. Several studies have observed a variety of adverse impacts to the male reproductive system of animals exposed to dieldrin (ATSDR, 2002b).

The avian and mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 669 papers with possible toxicity data for either avian or mammalian species. After a review of these papers 35 contained appropriate data for avian test species and 48 contained data for mammalian test species (USEPA, 2007g). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the NOAEL values for reproduction and growth was calculated at 1.05 mg/$kg_{bw}$/day. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 0.015 mg/$kg_{bw}$/day. This value corresponds to the reproduction NOAEL for a study with rats (USEPA, 2007g). The associated LOAEL from this study was 0.030 mg/$kg_{bw}$/day and this value was selected as the LOAEL-based TRV.

For birds, geometric mean of the NOAEL values for reproduction and growth was calculated at 0.889 mg/$kg_{bw}$/day. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 0.0709 mg/$kg_{bw}$/day. This value corresponds to the growth and survival NOAELs for a study with mallard ducks (USEPA, 2007g). The associated LOAEL from this study was 3.78 mg/$kg_{bw}$/day and this value was selected as the LOAEL-based TRV.

## 2.14 Endrin

Endrin is a solid, white, almost odorless substance used as a pesticide to control insects, rodents and birds. Endrin has not been produced or sold for general use in the United States since 1986. Some estimates indicate that endrin may stay in soil for over 10 years. However, endrin is known to be broken down, by exposure to light or high temperatures to form endrin aldehyde and endrin ketone. Little is known about the properties of endrin aldehyde and endrin ketone (ATSDR, 1996).

Studies in animals report exposure to endrin can lead to nervous system effects and potential, birth defects (abnormal bone formation reported in rodents). One study in rodents indicates exposure to endrin aldehyde or endrin ketone can cause liver defects (ATSDR, 1996).

The mammalian TRVs for endrin were developed by ORNL (Sample et al., 1996) based on a reproductive toxicity study with the mouse (Good and Ware 1969, as cited by Sample et al., 1996). Mice were exposed to 5 ppm endrin in the diet for 120 days (encompassing gestation). Significant reproductive effects including reduced parental survival, reduced litter size, and reduced number of young/day were observed. Because the study considered exposure during gestation (a critical life stage), the 5 ppm dietary exposure level was considered a chronic LOAEL. Assuming a body weight of 0.03 kg (EPA 1988a as cited in Sample et al., 1996), a food consumption rate of 0.0055 kg/day, and incorporating an uncertainty factor of 0.1 for extrapolation from a LOAEL to a NOAEL, a final chronic NOAEL of 0.092 mg/$kg_{bw}$/day was derived and the 0.92 mg/$kg_{bw}$/day value represents the LOAEL-based TRV.

The avian TRVs for endrin were developed by ORNL (Sample et al., 1996) based on a reproductive toxicity study with the mallard duck (Spann et al., 1986 as cited by Sample et al., 1996). Endrin was fed to mallard ducks in their diet at two concentrations (1 and 3 ppm) over a period of 200 days during a critical lifestage (i.e., the period of reproduction). Because exposure occurred during a critical lifestage, and no significant differences were observed between exposed and control populations at either dietary exposure level, the 3 ppm dietary exposure was identified as a chronic NOAEL. Assuming a food consumption rate of 115 g/day (estimated based on the data of Heinz et al. 1989 as cited in Sample et al., 1996) and a body weight of 1.15 kg (measured in the study), the final chronic NOAEL of 0.3 mg/$kg_{bw}$/day was calculated. A factor of 4 was applied to the NOAEL-based TRV to estimate a LOAEL-based TRV of 1.2 mg/$kg_{bw}$/day.

## 2.15 Heptachlor/Heptachlor Epoxide

Heptachlor is a man-made organochlorine insecticide used in the 1960s and 1970s to control termites, ants, and soil insects in homes, seed grains, and on crops. Heptachlor can no longer be used to kill insects on crops or in homes and buildings. However, heptachlor is still approved by USEPA for killing fire ants in buried power transformers, although it is unclear whether or not it is still being used for this purpose in the United States. When pure, heptachlor exists as a white powder, while technical grade heptachlor is a tan powder. Technical-grade heptachlor was the form of heptachlor used most often as a pesticide. Heptachlor epoxide is a breakdown product of heptachlor that is made by bacteria in the environment. Within hours of entering the environment about 20% of heptachlor is changed to heptachlor epoxide (ATSDR, 2007c).

Animal studies have reported adverse effects on the liver, kidney, immune system, and nervous system, as well as adverse developmental and reproductive effects, including decreased postnatal survival, fetal resorptions and failure of animals to reproduce (ATSDR, 2007c).

Based on structural similarity the TRVs for heptachlor developed by ORNL were selected to represent heptachlor epoxide in this ecological risk assessment.

The mammalian TRVs for heptachlor were developed by ORNL (Sample et al., 1996) based on a reproductive toxicity study with the mink (Crum et al., 1993 as cited in Sample et al., 1996). Heptachlor was administered to minks in the diet at three concentrations (6.25, 12.5, and 25 ppm) over 181 days encompassing reproduction (a critical lifestage). Adverse effects were observed in all exposure groups. Observed effects included: 100% mortality in minks receiving 25 ppm heptachlor in the diet; reduced fertility, kit weight and kit survival in minks exposed to dietary levels of 12.5 ppm heptachlor; and minks exposed to 6.25 ppm heptachlor in the diet exhibited reduced kit weights. The study considered exposure over a critical lifestage and adverse effects were observed at all exposure levels; therefore, the heptachlor at a dietary exposure level of 6.25 ppm was identified as a chronic LOAEL. Assuming a food consumption rate of 0.137 kg/day (Bleeavins and Aulerich, 1981 as cited in Sample et al., 1996), a body weight of 1 kg (USEPA, 1993ea as cited in Sample et al., 1996), and incorporating an uncertainty factor of 0.1 for extrapolation from a LOAEL to a NOAEL, the final chronic NOAEL of 0.1 mg/$kg_{bw}$/day was calculated. Based on the test LOAEL of 6.25 ppm heptachlor in the diet, the LOAEL-based TRV was calculated to be 1 mg/$kg_{bw}$/day.

No appropriate study of the effects of heptachlor or heptachlor epoxide on avian receptors was found.

## 2.16 Methoxychlor

Methoxychlor is a man-made organochlorine insecticide effective in controlling a wide variety of insect pests. It is used in both agricultural and household applications. Methoxychlor is effective against flies, mosquitos, cockroaches, and a wide variety of other insects. This insecticide is used on agricultural crops and livestock, and in animal feed, barns, and grain storage bins. It is similar in structure to DDT but has a relatively low persistence in the environment. Most fish and animals change methoxychlor into other substances that are rapidly released from their bodies, so methoxychlor does not usually build up in the food chain. Pure methoxychlor is a pale-yellow powder with a slightly fruity odor. Animals exposed to high levels of methoxychlor exhibited neurological effects including tremors, convulsions, and seizures. Exposure to breakdown products of methoxychlor may cause effects similar to those produced by estrogen. Animal studies show that exposure to methoxychlor may adversely affect the ovaries, uterus, and estrus cycle in females and the testes and prostate in males. Fertility may be decreased in both male and female animals exposed to methoxychlor (ATSDR, 2002c).

The mammalian TRVs for methoxychlor were developed by ORNL (Sample et al., 1996) based on a reproductive toxicity study with the rat (Gray et al., 1988 as cited in Sample et al., 1996). Methoxychlor was administered to rats in the diet at four concentrations (25, 50, 100, and 200 ppm) over 11 months encompassing reproduction (a critical lifestage). Fertility and litter size were significantly reduced amongst exposure groups receiving 100 and 200 ppm methoxychlor in the diet. Significant effects were not observed in rats exposed to 50 ppm methoxychlor in the diet. The study considered exposure over a critical lifestage; therefore, the methoxychlor dietary exposure level of 500 ppm was identified as a chronic NOAEL. Assuming a food consumption rate of 0.028 kg/day (calculated using the allometric equation from EPA, 1988a as cited in Sample et al., 1996), and a body weight of 0.35 kg (USEPA, 1988a as cited in Sample et al., 1996), the final chronic NOAEL of 4 mg/$kg_{bw}$/day was calculated. Based on the test LOAEL of 100 ppm methoxychlor in the diet, the LOAEL-based TRV was calculated to be 8 mg/$kg_{bw}$/day.

No appropriate study of the effects of methoxychlor on avian receptors was found.

## 2.17 Polychlorinated Biphenyls (PCBs)

There are 209 possible polychlorinated biphenyl (PCB) isomers. Since 1974, all uses of PCBs in the United States have been confined to closed systems such as electrical capacitors, electrical transformers, vacuum pumps, and gas-transmission turbines. PCBs are no longer produced in the United States except for limited research and development applications. Consumer products that may contain PCBs include old fluorescent lighting fixtures, electrical devices or appliances which incorporate PCB capacitors made before PCB use was stopped (ATSDR, 2000).

In animal studies, exposure to PCBs has been reported to cause possible liver, kidney, and central nervous system effects. Animals exposed to PCBs have also exhibited learning deficits, impaired immune function, cellular alterations of the thyroid, and reproductive effects such as decreased fertility, decreased conception, and disruption of the ovarian cycle (ATSDR, 2000).

The avian TRVs were derived based on two wading bird studies. Rattner et al. (2001) examined reproductive endpoints (fledgling) of the black-crowned night heron with a sample size of 69 nests in Baltimore Harbor. Straub et al. (2007) also examined fledging based on a sample size of 10 nests and observations ceased after hatching. Both studies offer unbounded NOAELs based on doses associated with maximum concentrations measured in diet (0.25 and 0.043 kg/day, respectively). The 0.25 kg/day NOAEL identified by Rattner et al. (2001) was selected as an upper bound NOAEL for reproductive effects for wading birds exposed to PCBs. A factor of 10 was applied to the NOAEL-based TRV to estimate a LOAEL-based TRV of 2.5 mg/$kg_{bw}$/day.

The mammalian TRVs were derived the methodology of ORNL (Sample et al., 1996) based on a chronic toxicity study of ring-necked pheasant exposure to Aroclor 1254 (Dahlgren et al., 1972). Aroclor 1254 was administered weekly over 17 weeks to pheasants at 2 dose levels: 12.5 and 50 mg/bird/week. Reproductive effects were monitored and reduced egg hatchability was not impacted in the 12.5 mg/bird/week dose, but was reduced in the 50 mg/bird/week dose. Therefore, the lowest dose level was considered the chronic NOAEL. Assuming a body weight of 1 kg (EPA, 1993 as cited in Sample et al., 1996) the final chronic NOAEL was calculated to be 1.8 mg/$kg_{bw}$/day and the LOAEL was 7.2 mg/$kg_{bw}$/day. Therefore, the LOAEL- and NOAEL-based TRVs for birds were 7.2 mg/$kg_{bw}$/day and 1.8 mg/$kg_{bw}$/day, respectively.

## 2.18 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are organic compounds, which consist of only carbon and hydrogen with a fused ring structure containing at least two benzene (six-sided) rings. PAHs are formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. There are more than 100 different PAHs. PAHs generally occur as complex mixtures (for example, as part of combustion products such as soot), not as single compounds. Generally, PAHs exist as colorless, white, or pale yellow-green solids. PAHs are produced by the incomplete combustion of fossil fuels and vegetable matter, resulting in the presence of PAHs in motor vehicle exhaust, smoke from residential wood combustion, and fly ash from coal-fired electric generating plants. PAHs can be formed from any naturally-occurring combustion, such as forest fires and active volcanoes (ATSDR, 1995; California EPA, 1997g; Irwin et al., 1997).

Laboratory animals exposed to PAHs have exhibited a variety of adverse effects including: alterations in the enzymes of the gastrointestinal tract; increased liver weights; blood effects; and adverse impacts to the immune system. Animals exposed to benzo(a)pyrene have also exhibited adverse reproductive effects, including reduced incidence of pregnancy, decreased fertility, and developmental effects such as reduced viability of litters, reduced mean pup weight, and decreased fertility in offspring (ATSDR, 1995; California EPA, 1997g; Irwin et al., 1997).

The mammalian TRVs were derived according to the Eco-SSL guidance (USEPA, 2007a). The literature search identified 5,478 papers with possible PAH toxicity data for either avian or mammalian species. After a review of these papers 2 contained appropriate data for avian test species and 46 contained data for mammalian test species (USEPA, 2007h). In the TRV derivation process, the NOAEL results for growth and reproduction are used to calculate a geometric mean. This result is examined in relationship to the lowest bounded LOAEL for reproduction, growth, and survival to derive the TRV according to procedures in the Eco-SSL guidance (USEPA, 2007a).

For mammals, the geometric mean of the low molecular weight PAH NOAEL values for reproduction and growth was calculated at 170 $mg/kg_{bw}/day$. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 65.6 $mg/kg_{bw}/day$. This value corresponds to the growth NOAEL for a study with rats (USEPA, 2007h). The associated LOAEL from this study was 328 $mg/kg_{bw}/day$ and this value was selected as the LOAEL-based TRV.

For mammals, the geometric mean of the high molecular weight PAH NOAEL values for reproduction and growth was calculated at 18 $mg/kg_{bw}/day$. However, this value is higher than the lowest bounded LOAEL for reproduction, growth, or mortality results. Therefore, the TRV is equal to the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival, and is equal to 0.615 $mg/kg_{bw}/day$. This value corresponds to the survival NOAEL for a study with mice (USEPA, 2007h). The associated LOAEL from this study was 3.07 $mg/kg_{bw}/day$ and this value was selected as the LOAEL-based TRV.

During the development of the Eco-SSLs, there was not enough data to derive avian TRVs for either low or high molecular weight PAHs. Therefore the avian TRVs are based on a subchronic toxicity study with mallards (Patton and Deter, 1980 as cited in Eisler, 1987). A mixture of naphthalenes, naphthenes and phenanthrene was fed to mallards in their diet at one dose level for seven months. No adverse effects were observed on either survival or reproduction at the given dose (NOAEL = 4000 mg/kg dose). Given a food consumption rate of 0.1 kg/day and an uncertainty factor of 0.1 for subchronic extrapolation, the final chronic NOAEL of 40 $mg/kg_{bw}/day$ was calculated this value was selected as the NOAEL-based TRV. A factor of 4 was applied to the NOAEL-based TRV to estimate a LOAEL-based TRV of 160 $mg/kg_{bw}/day$.

## 2.19 2,3,7,8-TCDD (dioxins)

Dioxin is the abbreviated name of a class of polychlorinated compounds called polychlorinated dibenzo-*p*-dioxin. In total, up to 75 different congeners are possible for chlorinated dibenzo-*p*-dioxin compounds, 17 of which pose major health risks with the most toxic being 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD).Dioxins are highly persistent in the environment. Typically they are by-products of industrial processes involving chlorine such as waste incineration, chemical and pesticide manufacturing, as well as pulp and paper bleaching. Dioxins may also be formed naturally as a result of forest fires or volcanic activity (ATSDR, 1998).

The typical protocol for evaluating toxicity of dioxins is to apply toxicity equivalence to the mixture, rather than evaluating toxicity for each individual congener. Since 2,3,7,8-TCDD is the most toxic of the congeners, the remaining congeners are considered relative to 2,3,7,8-TCDD using toxicity equivalence factors (TEFs) for each congener. The World Health Organization (WHO) has derived separate TEFs for fish, birds, and mammals (Van den Berg *et al.*, 1998 and 2006).

The mammalian TRVs for 2,3,7,8-TCDD were developed by ORNL (Sample et al., 1996) based on a chronic toxicity study with the rat. Murray et al. (1979) subjected three generations of rats to three dose levels of 2,3,7,8-TCDD (0.001, 0.01, and 0.1 ug/$kg_{bw}$/day). Fertility and neonatal survival was significantly reduced among rats receiving 0.1 and 0.01 ug/$kg_{bw}$/day. Because no significant differences were observed at the 0.001 ug/$kg_{bw}$/day dose level and the study considered exposure throughout three generations including critical lifestages (reproduction), this dose was considered to be a chronic NOAEL and is the NOAEL-based TRV (0.000001 mg/$kg_{bw}$/day). The 0.01 ug/$kg_{bw}$/day dose was considered to be a chronic LOAEL and is the LOAEL-based TRV (0.00001 mg/$kg_{bw}$/day).

The avian TRVs for 2,3,7,8-TCDD were also developed by ORNL (Sample et al., 1996) based on a chronic study with the ring-necked pheasant. Nosek et al. (1992) dosed the birds with a weekly intraperitoneal injection at three dose levels. The weekly intraperitoneal injection exposure route used in this study is believed to be comparable to oral routes of exposure (USEPA 1995). Egg production and hatchability was significantly reduced among birds receiving the 0.0014 mg/$kg_{bw}$/day dose but no significant effects were observed among the other two dose levels (0.00014 and 0.000014 mg/$kg_{bw}$/day). Because no significant differences were observed at the two lower dose levels and the study considered exposure throughout a critical lifestage (reproduction), the 0.000014 mg/$kg_{bw}$/day dose was considered to be the NOAEL and the 0.00014 mg/$kg_{bw}$/day dose was considered to be the LOAEL. These values were adopted as the dioxin NOAEL-based TRV and LOAEL-based TRV, respectively, for avian species.

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# Attachment I Table 2
## Porewater Sample-by-Sample Screen

| | | Reference Samples | | | | | |
|---|---|---|---|---|---|---|---|
| | Area | Reference | Reference | Reference | Reference | Reference | Reference |
| | Location ID | SEDBACK16 | SEDBACK17 | SEDBACK18 | SEDBACK19 | SEDBACK19 | SEDBACK20 |
| | Sample ID | PWBACK1600N | PWBACK1700N | PWBACK1800N | PWBACK1900N | PWBACK1900R | PWBACK2000N |
| | Sample Date | 6/12/2017 | 6/12/2017 | 6/12/2017 | 6/13/2017 | 6/13/2017 | 6/13/2017 |
| | Sample Type | N | N | N | N | FD | N |
| **Detected Analyte** | **Chronic ESV (a)** | | | | | | |
| **Metals - Dissolved Phase** | | | | | | | |
| Barium | **4** | **340** | **300** | **220** | **310** | **240** | **280** |
| Iron | **1000** | **26000** | **45000** | **10000** | 210 | 240 | **38000** |
| Manganese | **120** | **9600** | **7600** | **3800** | **2700** | **2800** | **6900** |
| **Metals - Total Phase** | | | | | | | |
| Iron | **300** | **52000** | **65000** | **25000** | **33000 J** | **14000 J** | **49000 J** |
| **Semi-volatile Organic Compounds** | | | | | | | |
| Pyrene | **0.025** | 0.01 J | 0.01 J | 0.02 J | 0.02 J | 0.02 J | **0.03 J** |

Notes:
All concentrations reported in micrograms per liter (ug/l).
Yellow highlighted cells indicate concentrations that are greater than the chronic ESV.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
FD - Field duplicate.
N - Normal sample.
NV - No ESV or Effects-based ESV Available.
J - Estimated value.
PAH - Polycyclic Aromatic Hydrocarbon.
U - Not detected.
USEPA - United States Environmental Protection Agency.
WQS - Water Quality Standards.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DOEE WQS (DOEE, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and other literature values (Suter and Tsao 1996, Buchman 2008).

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# Attachment I

# Sample-by-Sample Screens of Sediment and Pore Water

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location Group | Site | Site | Site | Site | Site | Site |
| | | | | Location ID | R5-03 | R5-04 | R5-05 | R5-06 | R5-08 | R5-09 |
| | | | | Sample ID | RI-R5-03-SS | RI-R5-04-SS | RI-R5-05-SS | RI-R5-06-SS | P2-R5-08-SS | P2-R5-09-SS |
| | | | | Sample Type Code | N | N | N | N | N | N |
| | | | | Sample Date | 7/25/2014 | 7/28/2014 | 7/30/2014 | 4/30/2015 | 6/9/2016 | 6/28/2016 |
| | | | | Task Code | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase2 | DOEE_Phase2 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | 3.3E-05 J | | 1.1E-05 J | 3.5E-05 | 2.2E-05 J |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | 1.90E-04 | | 6.60E-05 | 1.70E-04 | 1.20E-04 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | 3E-06 J | | 1E-06 J | 4E-06 U | 1.7E-06 J |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | 5.1E-06 J | | 2.3E-06 J | 1.10E-05 | 3.1E-06 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | 3.5E-06 J | | 1.9E-06 J | 7.00E-06 | 2.3E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | 5.4E-06 J | | 2.5E-08 U | 7.00E-06 | 2.3E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | 7.4E-06 J | | 4E-06 J | 1.30E-05 | 5.10E-06 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | 7.6E-08 U | | 1.3E-07 J | 6.3E-07 U | 5.9E-08 U |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | 1E-05 J | | 4.90E-06 | 1.70E-05 | 5.90E-06 |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | 1.2E-06 J | | 9.3E-07 J | 3.2E-06 J | 6.3E-07 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | 2.4E-06 J | | 3.4E-06 J | 5.3E-06 J | 1.5E-06 J |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | 3.5E-06 J | | 1.4E-06 J | 6.50E-06 | 2E-06 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | 3E-06 J | | 1.8E-06 J | 6.60E-06 | 1.7E-06 J |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | 2.3E-06 J | | 1.40E-06 | 3.2E-06 J | 1.10E-06 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | 7.2E-07 J | | 5.2E-07 J | 1.10E-06 | 3.4E-07 J |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | 7.50E-05 | | 2.20E-05 | 5.1E-05 U | 4.60E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | 6.60E-03 | | 2.20E-03 | 0.0042 J | 3.40E-03 |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 7500 | 11000 | 8000 | 9500 | 7200 | |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.62 J | 0.47 J | 0.39 J | 0.37 J+ | 0.62 J | |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 3.2 J | 3.6 J | 2.3 | 2.9 | 4.4 J | |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **62** | **81** | **63** | **72** | **73** | |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.88 | 1.1 | 0.83 | 0.82 | 0.95 | |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 11 | 15 | 10 J | 16 | 14 | |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 170 | 340 | 180 | 240 | 270 J | |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 22 | 27 J | 20 | 30 | 32 | |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.16 | 0.18 | 0.15 | 0.22 J+ | 0.17 | |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 33 J | 37 J | 27 J | 32 | 55 | |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | 140 U | **240 J** | **180 J** | **430 J** | **560** | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.0011 J | 0.0015 J | 0.0013 J | 0.0015 J | 0.0027 J | |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | **0.045** | **0.054** | **0.071** | **0.035 J** | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.097 | 0.053 | 0.11 | 0.091 | 0.35 | |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | 0.16 | 0.19 | 0.24 | 0.1 | 0.47 | 0.1 |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.8 | 0.44 | 0.85 | **1.3** | 0.36 | |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.94 | 0.6 J | 0.99 | 1.4 | 0.39 | |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 1.4 | 0.83 J | 1.4 | 1.9 | 0.57 | |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.43 | 0.34 J | 0.59 | 0.75 | 0.22 | |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | 0.13 U | 1.4 J | 0.13 U | 0.96 J | 0.14 U | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | **1.9** | **1.3 J** | **1.6** | **1.1** | **1.3** | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | **1.3** | 0.75 | **1.3** | **1.7** | 0.56 | |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.22** | **0.16 J** | **0.25** | **0.37** | 0.1 | |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | 0.033 U | 0.081 UJ | 0.033 U | 0.034 U | 0.036 UJ | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.95** | **0.58 J** | **0.94** | **1.3** | **0.39** | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **11** | 6.5 | **11** | **16** | 4.6 | |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **22** | **9.4** | **15** | **15** | 5.1 | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 1.8 | 0.81 | 1.4 | 1.5 | 0.72 | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | **23** | 10 | 16 | 17 | 5.8 | |

# Attachment I Table 1
## Sediment Sample-by-Sample Screen

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | R6-01 | R6-02 | R6-03 | R6-04 | R6-04 | R6-05 |
| | | | | Sample ID | RI-R6-01-SS | RI-R6-02-SS | RI-R6-03-SS | RI-R6-04-SS | RI-R6-80-SS | RI-R6-05-SS |
| | | | | Sample Type Code | N | N | N | N | FD | N |
| | | | | Sample Date | 8/5/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 7/28/2014 | 8/4/2014 |
| | | | | Task Code | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | | | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | | | | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | | | | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | | | | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | | | | | |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | | | | | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | | | | | |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 4700 | 8500 | 14000 | 15500 | | 4400 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.49 J | 0.43 J | 0.33 J | 0.64 J | | 1.7 |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 1.9 J | 2.7 J | 6.7 J | 9.05 J | | 7.1 |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | 47 J | **61** | **86** | **105** | | **130** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.63 | 0.91 | 1.2 | 1.5 | | 0.43 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 7.8 J | 14 | 13 | 19.5 | | 6.9 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 150 | 210 | 410 | 305 | | 150 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 17 J | 25 J | 32 J | **59 J** | | **110** |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.13 | 0.16 | 0.2 | 0.33 | | 0.13 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 16 J | 32 J | 78 J | 140 J | | 180 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | 150 U | **150 J** | 140 U | **295 J** | | **270 J** |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.0017 J | 0.0015 J | 0.0036 J | 0.038 | | **0.07** |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | **0.043 J** | **0.047** | **0.13** | **0.084** | | 0.00015 U |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.081 | 0.058 | 0.46 | **0.98** | | **1.4** |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | 0.1 | 0.28 | **1** | **3.71** | | **1.3** |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.74 | 0.67 | 0.41 | 0.35 | | **2.3** |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.76 | 0.79 | 0.43 | 0.43 | | **2** |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 1 | 1.2 | 0.6 | 0.65 | | **2.6** |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.37 | 0.37 | 0.23 | 0.295 | | 0.96 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | 0.2 U | 1.2 J | 0.13 U | 1.2 J | | 0.17 U |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | 0.59 J | **0.97 J** | **0.77 J** | **1.7 J** | | 0.74 J |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.9 | 0.96 | 0.51 | 0.575 | | **2.4** |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.16** | **0.14** | 0.1 | 0.13 U | | **0.47** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | 0.052 U | 0.07 UJ | 0.032 UJ | 0.082 UJ | | 0.044 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.61** | **0.69** | 0.33 | **0.38** | | **1.4** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **8.4** | **8.6** | 4.6 | 4.69 | | **24** |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **10** | **8.8** | 4.5 | 3.76 | | 5.5 |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 1.1 | 1 | 0.82 | 0.59 | | 0.97 |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | 11 | 9.8 | 5.3 | 4.35 | | 6.5 |

## Attachment I Table 1
## Sediment Sample-by-Sample Screen

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | R6-06 | R6-06 | R6-07 | R6-18 | R6-21 | R6-22 |
| | | | | Sample ID | RI-R6-06-SS | RI-R6-100-SS | RI-R6-07-SS | RI-R6-18-SS | RI-R6-21-SS | RI-R6-22-SS |
| | | | | Sample Type Code | N | FD | N | N | N | N |
| | | | | Sample Date | 8/4/2014 | 8/4/2014 | 7/30/2014 | 4/30/2015 | 4/29/2015 | 4/30/2015 |
| | | | | Task Code | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 | DOEE_Phase1 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | | | 2.1E-05 J | 1.30E-04 | 3E-05 J |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | | | 1.20E-04 | 4.80E-04 | 1.90E-04 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | | | 1.7E-06 J | 2.10E-05 | 2.5E-06 J |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | | | 4.5E-06 J | 5.80E-05 | 5.70E-06 |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | | | 2.7E-06 J | 3.40E-05 | 4E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | | | 4.3E-06 J | 3.2E-05 J | 3.3E-08 U |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | | | 5.90E-06 | 5.90E-05 | 7.80E-06 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | | | 1.5E-07 U | 3.2E-06 J | 2.2E-07 J |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | | | 6.80E-06 | 8.60E-05 | 1.00E-05 |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | | | 1.3E-06 J | 1.40E-05 | 1.4E-06 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | | | 2.2E-06 J | 2.7E-05 J | 2.5E-06 J |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | | | 2.6E-06 J | 3.6E-05 J | 3.1E-06 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | | | 2.6E-06 J | 2.60E-05 | 2.8E-06 J |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | | | 2E-06 J | 8.70E-06 | 2.40E-06 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | | | 7.2E-07 J | 4.60E-06 | 8.4E-07 J |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | | | 3.90E-05 | 0.00012 J | 6.60E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | | | 3.60E-03 | 3.60E-03 | 0.0072 J |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 7100 | | 13000 | 12000 | 6000 | 12000 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.46 | | 0.42 J | 0.58 | 0.67 J | 0.48 J+ |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 2.9 | | 5.2 | 5.1 | 5.1 J | 4.3 |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **66.5** | | **96** | **98** | **88** | **85** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.905 | | 1.4 | 1.1 | 0.66 | 1.1 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 11 | | 16 J | 25 | 9.8 | 18 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 210 | | 360 | 370 | 120 | 260 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 24 | | 21 | 42 | 28 J | 36 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.175 | | 0.22 | 0.28 J+ | 0.15 J | 0.25 J+ |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 22 | | 37 J | 42 | 59 J | 40 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | **620 J** | | 160 U | **4900** | 170 U | **740** |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.0025 J | | 0.00072 J | 0.0014 J | 0.0026 J | 0.001 J |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | **0.059** | | **0.022** | **0.059 J** | **0.042 J** | **0.049 J** |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.0845 | | 0.028 | 0.088 | 0.42 | 0.089 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | 0.1279 | | 0.038 | 0.19 | **0.96** | 0.19 |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.37 | | 0.4 | 1 | 0.21 J | 0.6 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.43 | | 0.42 | 1.1 | 0.24 J | 0.73 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.69 | | 0.55 | 1.7 | 0.37 J | 1.1 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.245 | | 0.2 | 0.42 | 0.13 J | 0.32 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | 0.27 U | | 0.077 U | 1.2 J | 0.14 U | 1 J |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | 0.615 J | | 0.32 J | **4** | **10** | **1.2** |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.575 | | 0.54 | **1.3** | 0.34 J | 0.94 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.11 J** | | 0.094 | **0.27** | 0.058 J | **0.2** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | 0.068 U | | 0.02 U | **0.4 J** | 0.036 U | 0.036 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.41** | | **0.36** | **1.1** | 0.18 J | **0.8** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | 5.01 | | 4.4 | **12** | 2.7 | **8.1** |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **11.3** | | 4 | **8.4** | 3.1 | **8.6** |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 1.08 | | 0.58 | 0.64 | 0.81 | 0.7 |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | 12.4 | | 4.6 | 9 | 3.9 | 9.3 |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | R6-23 | R6-30 | R6-30 | R6-31 | R6-32 | R6-33 |
| | | | | Sample ID | RI-R6-23-SS | P2-R6-30-SS | P2-R6-40-SS | P2-R6-31-SS | P2-R6-32-SS | P2-R6-33-SS |
| | | | | Sample Type Code | N | N | FD | N | N | N |
| | | | | Sample Date | 4/30/2015 | 6/9/2016 | 6/9/2016 | 6/28/2016 | 6/28/2016 | 6/28/2016 |
| | | | | Task Code | DOEE_Phase1 | DOEE_Phase2 | DOEE_Phase2 | DOEE_Phase2 | DOEE_Phase2 | DOEE_Phase2 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | 2.7E-05 J | 4.65E-05 J | | 1.8E-05 | 5.50E-04 | 3.9E-06 J |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | 1.50E-04 | 2.80E-04 | | 1.10E-04 | 2.20E-03 | 2.40E-05 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | 1.8E-06 J | 4.1E-06 U | | 1.4E-06 U | 8.30E-05 | 9.5E-08 U |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | 3.6E-06 J | 1.3E-05 U | | 3.4E-06 J | 0.00023 J | 6.9E-07 U |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | 2.8E-06 J | 7.6E-06 U | | 2.2E-06 J | 1.60E-04 | 4.3E-07 U |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | 3.1E-08 U | 7.6E-06 U | | 2.7E-06 J | 0.00013 J | 5.4E-07 U |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | 6.30E-06 | 1.30E-05 | | 4.6E-06 J | 3.10E-04 | 9.8E-07 J |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | 2.1E-07 J | 4.3E-07 U | | 6.2E-08 U | 1.30E-05 | 3.6E-08 U |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | 6.90E-06 | 2.10E-05 | | 5.5E-06 J | 4.20E-04 | 1.1E-06 U |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | 8.2E-07 J | 2.9E-06 U | | 1.5E-06 J | 6.20E-05 | 1.5E-07 U |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | 1.6E-06 J | 6.3E-06 U | | 2E-06 J | 1.30E-04 | 3.6E-07 U |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | 2.2E-06 J | 6.4E-06 U | | 1.7E-06 J | 0.00015 J | 3E-07 U |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | 1.8E-06 J | 5.8E-06 U | | 2.2E-06 J | 1.30E-04 | 3.7E-07 U |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | 1.70E-06 | 2.85E-06 | | 1.50E-06 | 3.50E-05 | 5.8E-07 J |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | 4.7E-07 J | 9.9E-07 J | | 5.4E-07 J | 2.10E-05 | 8.8E-08 J |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | 5.50E-05 | 9.90E-05 | | 3.40E-05 | 0.0005 J | 1E-05 U |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | 0.0053 J | 0.0102 J | | 3.50E-03 | 0.012 J | 6.30E-04 |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 12000 | 7500 J | | 8200 J | 4300 J | 6300 J |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.47 J+ | 0.785 J | | 0.82 | 1.2 | 0.68 |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 3.8 | 4.55 J | | 4.1 J | 4 J | 3.3 J |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **78** | **69 J** | | **83** | 54 | **70** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.99 | 0.955 J | | 0.98 J | 0.58 J | 0.9 J |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 18 | 14.5 J | | 14 J | 9.6 J | 14 J |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 230 | 220 J | | 200 J | 97 J | 170 J |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 33 | 27.5 J | | 29 J | **50 J** | 25 J |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.22 J+ | 0.18 J | | 0.19 | 0.13 | 0.16 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 36 | 34 J | | 35 J | 75 J | 28 J |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | **1800** | **895 J** | | **380 J** | **550** | **480** |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.00086 J | 0.0029 J | | 5.7E-05 U | 4.4E-05 U | 0.0011 J |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | **0.051 J** | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.066 | 0.24 | | 0.043 | **0.73** | 0.022 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | 0.15 | 0.236 | | 0.24 | **1.8** | 0.17 |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.72 | 0.56 J | | 0.58 | 1 | 0.52 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.79 | 0.76 J | | 0.67 | 1.1 J | 0.58 J |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 1.1 | 1.2 J | | 1.1 | 1.7 J | 0.94 J |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.42 | 0.43 J | | 0.43 | 0.58 J | 0.3 J |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | 1.1 J | 0.7 UJ | | 0.97 J | 0.84 J | 0.75 J |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | **1.1** | **1.8 J** | | **1.8** | **2.3** | **1.1** |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 1.1 | 1 J | | 0.98 | **1.5** | 0.81 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.19** | 0.037 UJ | | **0.16** | **0.25 J** | **0.15 J** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | 0.036 U | 0.18 UJ | | 0.046 U | **0.34 J** | **0.29 J** |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.86** | **0.92 J** | | **0.65** | **0.91 J** | **0.55 J** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **9.2** | **9** | | **7.8** | **12** | **6.9** |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **11** | **12** | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 0.88 | 0.86 | | | | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | 12 | 12 | | | | |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED1.5B | SED1.5C | SED1.5C | SED10A | SED10B | SED10C |
| | | | | Sample ID | SED1.5B00N | SED1.5C00AN | SED1.5C00AR | SED10A00N | SED10B00N | SED10C00N |
| | | | | Sample Type Code | N | N | FD | N | N | N |
| | | | | Sample Date | 11/6/2013 | 6/21/2017 | 6/21/2017 | 11/11/2013 | 11/11/2013 | 11/11/2013 |
| | | | | Task Code | Phase2-2013 | WP#3-2017 Waterside | WP#3-2017 Waterside | Phase2-2013 | Phase2-2013 | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | | | | 4.33E-06 J | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | | | | 2.49E-05 | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | | | | 5.92E-07 J | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | | | | 5.74E-07 JN | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | | | | 4.79E-07 JN | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | | | | 1.13E-06 JN | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | | | | 1.18E-06 J | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | | | | 6.05E-08 JN | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | | | | 1.33E-06 J | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | | | | 1.93E-07 JN | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | | | | 4.8E-07 JN | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | | | | 5.2E-07 J | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | | | | 4.8E-07 J | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | | | | 2.88E-07 JN | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | | | | 5.93E-08 JN | |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | | | | 9.87E-06 J | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | | | | 0.000683 J | |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 10000 | 5600 | | 6900 | 3300 | 5300 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.48 J- | 0.6 J | | 0.05 J- | 0.2 J- | 0.31 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 4.1 | 3 | | 2.8 J- | 1.3 J- | 2.1 J- |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **98** | 52 | | **79 J+** | 38 | **63** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 1.3 | 0.75 | | 1.2 | 0.53 | 0.85 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 20 | 13 | | 13 J | 8.9 | 16 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 470 | 130 J | | 480 | 190 J+ | 210 J+ |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 38 | 23 | | 16 | 16 | 26 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.22 | 0.15 | | 0.11 J | 0.1 | 0.17 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 39 | 27 | | 23 J+ | 14 | 23 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | | | | | 0.0017 J | |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.23 | 0.087 | | 0.0031 | 0.066 | 0.077 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | 0.18 | | | | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | 0.3 U | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | 0.3 U | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 1 | 0.4 | | 0.021 J | 0.38 | 0.48 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 1.1 | 0.56 | | 0.028 J | 0.48 | 0.58 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 1.7 | 0.88 | | 0.043 | 0.7 | 0.84 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.54 | 0.31 | | 0.042 U | 0.29 | 0.35 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | | | | **1.1** | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | **1.5** | 0.65 | | 0.031 J | 0.58 | 0.7 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.21** | **0.13 J** | | 0.042 U | **0.11** | **0.14** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | | | | 0.3 U | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **1.2** | **0.44** | | 0.022 J | **0.38** | **0.42** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **13** | 5.6 | | 0.25 | 5 | 5.9 |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | 0.0553 | 0.034 | | | | 0.0127 J |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | 0.0499 | 0.033 | | | | 0.0211 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **13.4** | **13** | | | | **9.86** |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 1.5 | 1.1 | | | | 0.958 |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | 14.9 | 14 | | | | 10.8 |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED1A | SED1B | SED1C | SED2.5B | SED2A | SED2B |
| | | | | Sample ID | SED1A00N | SED1B00N | SED1C00N | SED2.5B00N | SED2A00N | SED2B00N |
| | | | | Sample Type Code | N | N | N | N | N | N |
| | | | | Sample Date | 11/6/2013 | 11/6/2013 | 11/7/2013 | 11/7/2013 | 11/6/2013 | 11/5/2013 |
| | | | | Task Code | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | 2.37E-07 J | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | 8.42E-06 | | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | 8E-08 JN | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | 9.02E-08 JN | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | 1.58E-07 JN | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | 1.05E-07 JN | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | 2.65E-07 J | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | 1.48E-08 U | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | 2.09E-07 JN | | | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | 1.77E-08 U | | | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | 4.26E-08 JN | | | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | 7.37E-08 JN | | | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | 1.56E-08 U | | | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | 1.18E-08 U | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | 1.31E-08 U | | | | |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | 5.14E-07 JN | | | | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | 3.43E-04 | | | | |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 11000 | 18000 | 5200 | 6500 | 8300 | 7600 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.62 J- | 0.29 | 0.39 | 0.39 | 0.53 J- | 0.48 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 4 | 3.9 | 2 | 1.9 | 3.6 | 2.9 |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **110** | **140** | 53 | 60 | **86** | **76** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 1.5 | 1.5 | 0.63 | 0.8 | 1.1 | 0.89 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 21 | 15 | 11 | 12 | 18 | 16 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 460 | 470 | 160 | 210 | 420 | 310 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 39 | 23 | 19 | 22 | 37 | 30 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.25 | 0.29 | 0.15 | 0.16 | 0.19 | 0.18 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 44 | 38 | 21 | 22 | 32 | 29 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | | 0.00037 J | | | | |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.15 | 0.078 | 0.11 | 0.076 | 0.23 | 0.11 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | 0.294 | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | 0.16 U | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | 0.16 U | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.36 | 0.26 | 0.49 | 0.61 | 0.42 | 0.39 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.46 | 0.3 | 0.55 | 0.71 | 0.37 | 0.45 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.92 | 0.44 | 0.73 | 1 | 0.82 | 0.64 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.25 J | 0.21 | 0.4 | 0.47 | 0.28 | 0.24 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | 0.52 | | | | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.69 | 0.4 | 0.71 | 0.94 | 0.76 | 0.62 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.13 J** | 0.065 | **0.11 J** | **0.17 J** | **0.17 J** | 0.1 J |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | 0.16 U | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.44** | 0.27 | **0.4** | **0.61** | 0.14 J | **0.41** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | 5.5 | 3.3 | 5.8 | **7.9** | 5.5 | 5.1 |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | | | | | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | | | | | |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED2C | SED3.5B | SED3A | SED3B | SED3C | SED3C |
| | | | | Sample ID | SED2C00N | SED3.5B00N | SED3A00N | SED3B00N | SED3C00N | SED3C00R |
| | | | | Sample Type Code | N | N | N | N | N | FD |
| | | | | Sample Date | 11/6/2013 | 11/12/2013 | 11/7/2013 | 11/8/2013 | 11/7/2013 | 11/7/2013 |
| | | | | Task Code | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | 1.55E-04 | | | | 6.61E-06 JN | 1.37E-05 JN |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | 1.81E-04 | | | | 3.21E-05 J | 5.78E-05 J |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | 4.83E-06 JN | | | | 7.05E-07 JN | 1.27E-06 JN |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | 0.000128 J | | | | 1.32E-06 JN | 2.07E-06 JN |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | 1.28E-05 | | | | 6.63E-07 J | 1.16E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | 3.58E-05 JN | | | | 1.61E-06 JN | 2.05E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | 1.79E-05 | | | | 1.31E-06 JN | 2.8E-06 J |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | 7.98E-07 JN | | | | 7.05E-08 JN | 1.21E-07 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | 3.32E-05 J | | | | 1.58E-06 JN | 3.09E-06 J |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | 1.71E-05 | | | | 4.5E-07 JN | 7.36E-07 JN |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | 1.05E-05 | | | | 4E-07 JN | 1.23E-06 JN |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | 2.66E-05 JN | | | | 6.1E-07 J | 1.19E-06 JN |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | 2.83E-05 | | | | 9.98E-07 JN | 1.65E-06 JN |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | 9.98E-06 | | | | 4.68E-07 JN | 8.25E-07 JN |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | 2.08E-06 JN | | | | 2.41E-08 U | 3.34E-07 JN |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | 3.90E-05 | | | | 1.38E-05 | 2.17E-05 |
| Octachlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | 3.18E-03 | | | | 0.000617 J | 0.00142 J |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 6200 | 2000 | 14000 | 1900 | 5900 | 5300 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.5 J- | 0.15 J- | 0.2 U | 0.17 | 0.52 | 0.4 |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 2.6 | 0.96 J- | 1.8 | 0.79 | 2.3 | 2.6 |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **61** | 30 | **180** | 29 | **61** | 55 |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.82 | 0.36 | 1.9 | 0.32 | 0.76 | 0.69 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 18 | 6.7 | 16 | 4.8 | 13 | 12 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 200 | 120 J+ | 300 | 120 J- | 200 | 190 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 29 | 11 | 26 | 8 | 23 | 21 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.19 | 0.065 J | 0.18 | 0.057 J | 0.18 | 0.15 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 27 | 9.6 | 26 | 8.5 J+ | 26 | 30 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.0028 J | | | | 0.0007 J | 0.0048 J |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.23 | 0.05 | 0.0084 U | 0.042 | 0.19 | 0.16 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | 1.3 U | | | | 0.34 U | 0.36 U |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | 1.3 U | | | | **0.071 J** | 0.36 U |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.59 | 0.11 | 0.0067 U | 0.11 | 0.62 | 0.41 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.67 | 0.13 | 0.0067 U | 0.13 | 0.7 | 0.49 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.73 | 0.21 | 0.0067 U | 0.21 | 1 | 0.71 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.56 | 0.066 | 0.0067 U | 0.09 | 0.32 | 0.25 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | **1.5 J** | | | | **0.84** | 0.64 J |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.9 | 0.19 | 0.0067 U | 0.19 | 0.93 | 0.65 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.2 J** | 0.024 J | 0.0067 U | 0.032 | **0.17** | **0.13** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | 1.3 U | | | | 0.042 J | 0.36 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.58** | 0.088 | 0.0067 U | 0.11 | **0.6** | **0.44** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **7.3** | 1.4 | 0.0067 U | 1.6 | **7.8** | 5.5 |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | | | | | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | | | | | |

## Attachment I Table 1
## Sediment Sample-by-Sample Screen

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED4.5B | SED4A | SED4B | SED4B | SED4C | SED5.5B |
| | | | | Sample ID | SED4.5B00N | SED4A00N | SED4B00N | SED4B00R | SED4C00N | SED5.5B00N |
| | | | | Sample Type Code | N | N | N | FD | N | N |
| | | | | Sample Date | 11/8/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 | 11/12/2013 |
| | | | | Task Code | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | | 3.44E-05 J | 1.1E-05 J | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | | 0.000149 J | 5.03E-05 J | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | | 2.74E-06 J | 1.05E-06 J | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | | 7.26E-06 JN | 2.29E-06 JN | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | | 2.38E-06 J | 9.3E-07 J | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | | 1.14E-05 JN | 5.05E-06 JN | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | | 6.81E-06 | 3.06E-06 J | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | | 2.95E-07 J | 2.12E-07 JN | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | | 5.99E-06 | 2.59E-06 J | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | | 1.95E-06 J | 7.47E-07 JN | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | | 3.91E-06 JN | 7.86E-07 JN | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | | 4.78E-06 | 1.81E-06 JN | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | | 5.61E-06 JN | 2.05E-06 JN | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | | 6.38E-06 JN | 1.84E-06 JN | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | | 2.71E-06 JN | 7.39E-07 J | | |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | | 5.08E-05 J | 1.85E-05 J | | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | | 0.006 J | 0.00181 J | | |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 13000 | 9400 | 4800 | 6000 | 10000 | 11000 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.87 | 0.47 J- | 0.15 J- | 0.15 J- | 0.64 J- | 0.56 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 4.1 | 3.6 J- | 2.7 J- | 3 J- | 3.4 J- | 4.2 J- |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **120** | **120** | **76** | **98** | **110** | **130** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 1.6 | 1.5 | 0.73 | 0.85 | 1.4 | 1.5 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 23 | 23 | 10 | 11 | 19 | 22 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 560 J- | 570 J+ | 160 J+ | 170 J+ | 390 | 530 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 40 | 39 | 16 | 20 | 37 | 33 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.28 | 0.25 | 0.15 | 0.19 | 0.25 | 0.27 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 42 J+ | 38 | 23 | 27 | 41 | 43 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | | | **1.5 J** | 0.0014 J | | |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.19 | 0.15 | 0.31 | **0.87** | 0.39 | 0.16 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | | 0.24 |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | 0.12 U | 0.12 U | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | **0.015 J** | **0.027 J** | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.5 | 0.41 | 0.35 J | 1 J | 0.47 | 0.41 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.58 | 0.53 | 0.34 J | 0.93 J | 0.55 | 0.51 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.95 | 0.87 | 0.4 J | 0.91 J | 0.94 | 0.78 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.38 | 0.3 | 0.15 J | 0.49 J | 0.32 | 0.29 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | | 0.19 J | 0.21 J | | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 1 | 0.8 | 0.41 J | 1.1 J | 0.83 | 0.8 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.14** | **0.16** | 0.068 | **0.17** | **0.16** | **0.11** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | | 0.12 U | 0.12 UJ | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.55** | **0.53** | 0.22 J | **0.6 J** | **0.59** | **0.41** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **7.2** | 6.1 | 3.5 | **10** | 6.4 | 5.7 |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | 0.0179 J | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | 0.0457 | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | **7.29** | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | 0.554 | | | | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | 7.84 | | | | |

## Attachment I Table 1
## Sediment Sample-by-Sample Screen

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED5A | SED5B | SED5B | SED5C | SED6.5D | SED6.5D |
| | | | | Sample ID | SED5A00N | SED5B00AN | SED5B00N | SED5C00N | SED6.5D00EN | SED6.5D00N |
| | | | | Sample Type Code | N | N | N | N | N | N |
| | | | | Sample Date | 11/8/2013 | 6/20/2017 | 11/8/2013 | 11/11/2013 | 6/9/2017 | 11/25/2013 |
| | | | | Task Code | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | | | | 2.33E-05 | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | | | | 9.74E-05 | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | | | | 2.16E-06 | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | | | | 4.90E-06 | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | | | | 4.59E-06 | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | | | | 5.37E-06 | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | | | | 8.94E-06 | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | | | | 3.85E-07 JN | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | | | | 7.44E-06 | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | | | | 3.13E-06 J | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | | | | 4.43E-06 | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | | | | 7.04E-06 | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | | | | 6.82E-06 J | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | | | | 2.29E-06 | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | | | | 9.18E-07 | |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | | | | 2.55E-05 | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | | | | 1.07E-03 | |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 11000 | 10000 | 15000 | 8000 | 8200 | 13000 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.59 | 1.1 | 0.8 | 0.27 J- | 1.3 | 0.77 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 3.5 | 6.1 | 4.6 | 5.3 J- | 7 | 14 J- |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **97** | **100** | **130** | **87 J+** | **81** | **120 J-** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 1.3 | 1.4 | 1.7 | 0.89 | 1.1 | 1.8 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 18 | 23 | 23 | 12 J | 16 | 17 J- |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 430 J- | 430 | 560 J- | 300 | 190 | 130 J- |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 33 | 40 | 41 | 20 | 47 | **91 J-** |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.23 | 0.21 | 0.28 | 0.27 | 0.22 | 0.53 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 36 J+ | 44 | 49 J+ | 61 J+ | 63 | 250 J+ |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | | | | | 0.00093 U | |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.13 | 0.18 | 0.23 | **0.75** | 0.16 | **1.8** |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.37 | 0.42 | 0.37 | 0.63 | | 0.19 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.45 | 0.52 | 0.44 | 0.78 | | 0.19 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.73 | 1.1 | 0.8 | 1.1 | | 0.32 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.29 | 0.34 | 0.25 | 0.39 | | 0.096 J |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | | | | | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.75 | 0.88 | 0.72 | 0.96 | | 0.32 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.14** | **0.14 J** | 0.096 | **0.17** | | 0.052 J |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.5** | **0.51** | **0.48** | **0.62** | | 0.14 J |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | 5.5 | **6.7** | 5.3 | **7.7** | | 2.3 |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | 0.022 J | | | 0.052 | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | 0.037 | | | 0.098 | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | **14** | | | **7.6** | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | 1.3 | | | 0.73 | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | 16 | | | 8.3 | |

# Attachment I Table 1
## Sediment Sample-by-Sample Screen

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED6.5E | SED6.5E | SED6A | SED6A | SED6B | SED6B |
| | | | | Sample ID | SED6.5E00EN | SED6.5E00N | SED6A00EN | SED6A00N | SED6B00EN | SED6B00N |
| | | | | Sample Type Code | N | N | N | N | N | N |
| | | | | Sample Date | 6/8/2017 | 11/25/2013 | 6/8/2017 | 11/13/2013 | 6/8/2017 | 11/13/2013 |
| | | | | Task Code | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | 6.58E-05 | 3.07E-04 | 6.56E-06 | | 4.79E-06 | 1.63E-05 JN |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | 2.37E-04 | 1.08E-03 | 4.35E-05 | | 3.82E-05 | 4.72E-05 J |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | 7.66E-06 | 4.16E-05 | 5.35E-07 J | | 3.7E-07 J | 8.09E-07 J |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | 1.62E-05 | 0.000158 JN | 4.27E-07 JN | | 4.16E-07 JN | 1.57E-06 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | 1.48E-05 | 8.35E-05 | 6.24E-07 J | | 5.17E-07 J | 8.61E-07 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | 1.74E-05 | 8.54E-05 | 6.07E-07 J | | 5.02E-07 J | 1.93E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | 2.69E-05 | 1.31E-04 | 1.52E-06 J | | 1.19E-06 J | 2.08E-06 JN |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | 2.53E-06 J | 6.56E-06 | 1.09E-07 U | | 1.24E-07 U | 1.09E-07 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | 2.35E-05 | 1.96E-04 | 1.48E-06 J | | 1.1E-06 J | 2.42E-06 JN |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | 1.05E-05 J | 4.59E-05 | 3.16E-07 J | | 1.74E-07 JN | 3.7E-07 JN |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | 1.54E-05 | 7.60E-05 | 4.89E-07 J | | 3.25E-07 JN | 8.59E-07 JN |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | 2.22E-05 | 8.13E-05 JN | 9.16E-07 J | | 8.08E-07 J | 8.88E-07 JN |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | 2.12E-05 J | 6.65E-05 | 1.2E-06 J | | 1E-06 JN | 9.88E-07 JN |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | 7.58E-06 | 2.56E-05 JN | 5.39E-07 J | | 4.12E-07 | 9.6E-07 J |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | 3.05E-06 | 1.37E-05 | 1.04E-07 U | | 1.02E-07 J | 2.64E-07 JN |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | 8.39E-05 | 2.89E-04 | 1.68E-05 | | 1.13E-05 | 1.87E-05 J |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | 2.42E-03 | 0.00861 J | 1.12E-03 | | 9.11E-04 | 1.44E-03 |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 7000 | 6000 | 8200 | 2000 | 5200 | 5500 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 2.8 | 1.4 J- | 0.82 | 0.13 J- | 0.42 | 0.35 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 6.1 | 5.9 J- | 4.5 | 1.2 J- | 2.8 | 1.8 J- |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **70** | **79** | **83** | 29 | 54 | 60 |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.89 | 0.73 | 1.1 | 0.37 | 0.78 | 0.77 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 16 | 16 | 18 | 5.3 | 10 | 12 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 160 | 150 | 300 | 100 | 200 | 260 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 47 | **65 J-** | 31 | 7.7 | 19 | 22 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.18 | 0.16 J- | 0.18 | 0.07 | 0.12 | 0.13 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 77 | 120 | 33 | 11 | 21 | 20 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.001 U | 0.0019 J | 0.0012 U | | 0.00082 U | 0.0037 J |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.25 | 0.4 | 0.069 | 0.14 | 0.13 | 0.12 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | **0.76** | 0.18 | | 0.21 | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | 0.3 U | | | | 0.29 U |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | **0.055 J** | | | | 0.29 U |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | | 0.4 | | 0.39 | | 0.48 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | | 0.46 | | 0.43 | | 0.61 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | | 0.73 | | 0.47 | | 0.85 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | | 0.25 | | 0.16 | | 0.31 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | **1.3** | | | | **1.1** |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | | 0.74 | | 0.47 | | 0.8 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | | **0.14** | | 0.088 | | **0.14** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | 0.3 U | | | | 0.1 J |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | | **0.42** | | 0.29 | | **0.53** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | | 5.6 | | 4.4 | | **6.6** |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | 0.096 | | 0.013 J | | 0.015 J | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | 0.14 | | 0.022 J | | 0.063 | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **9** | | **11** | | **8.8** | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 0.92 | | 0.78 | | 0.69 | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | 10 | | 12 | | 9.5 | |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED6B | SED6C | SED6C | SED7.5D | SED7.5D | SED7.5E |
| | | | | Sample ID | SED6B00R | SED6C00EN | SED6C00N | SED7.5D00EN | SED7.5D00N | SED7.5E00EN |
| | | | | Sample Type Code | FD | N | N | N | N | N |
| | | | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 6/9/2017 | 11/25/2013 | 6/8/2017 |
| | | | | Task Code | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | 2.1E-05 JN | 2.51E-05 | | 9.36E-05 | | 6.67E-05 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | 0.000105 J | 1.43E-04 | | 3.82E-04 | | 2.44E-04 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | 1.64E-06 JN | 2.14E-06 JN | | 1.20E-05 | | 7.79E-06 |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | 1.67E-06 J | 4.14E-06 | | 1.86E-05 | | 1.21E-05 |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | 1.19E-06 JN | 3.63E-06 | | 1.96E-05 | | 1.45E-05 |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | 2.75E-06 JN | 4.63E-06 | | 2.08E-05 | | 1.49E-05 |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | 3.42E-06 J | 7.98E-06 | | 4.00E-05 | | 2.64E-05 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | 1.41E-07 JN | 4.55E-07 JN | | 1E-06 J | | 1.19E-06 J |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | 2.53E-06 J | 6.07E-06 | | 3.24E-05 | | 2.11E-05 |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | 3.6E-07 JN | 2.09E-06 J | | 1.01E-05 J | | 7.29E-06 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | 9.97E-07 JN | 3.18E-06 | | 1.84E-05 | | 1.35E-05 |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | 9E-07 J | 6.01E-06 | | 2.95E-05 | | 2.00E-05 |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | 1.01E-06 JN | 8.32E-06 J | | 2.63E-05 J | | 2.01E-05 J |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | 1.22E-06 | 2.23E-06 | | 7.35E-06 | | 5.24E-06 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | 2.56E-07 JN | 7.43E-07 | | 3.94E-06 | | 2.36E-06 |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | 4.64E-05 JN | 5.52E-05 | | 1.29E-04 | | 9.57E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | 2.06E-03 | 3.79E-03 | | 4.57E-03 | | 2.03E-03 |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 5600 | 13000 | 9800 | 12000 | 13000 | 8900 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.35 J- | 1 | 0.49 J- | 1.7 | 0.43 J- | 2.3 |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 2 J- | 6.4 | 3.6 J- | 6.8 | 11 J- | 17 |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **74** | **110** | **89** | **110** | **97 J-** | **110** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.86 | 1.7 | 1.3 | 1.6 | 1.7 | 1.1 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 14 | 22 | 19 | 20 | 15 J- | 23 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 300 | 430 | 390 | 250 | 180 J- | 190 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 24 | 42 | 36 | **57** | **59 J-** | **97** |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.16 | 0.24 | 0.23 J- | 0.26 | 0.35 | 0.27 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 22 | 48 | 37 | 88 | 180 J+ | 160 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.0051 J | 0.0013 U | | 0.00098 U | | 0.0012 U |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.09 | 0.29 | 0.24 | 0.54 | **0.87** | **0.78** |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | | **1.4** |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | 0.3 U | | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | 0.3 U | | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.52 | | 0.42 J | | 0.16 | |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.65 | | 0.53 J | | 0.16 | |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.91 | | 0.85 J | | 0.29 | |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.33 | | 0.33 J | | 0.1 | |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | **1.2** | | | | | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.84 | | 0.85 J | | 0.27 | |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.15** | | 0.089 J | | 0.04 J | |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | 0.043 J | | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.55** | | **0.35 J** | | 0.12 | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **6.9** | | 5.7 | | 2 | |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | 0.026 | | 0.076 | | 0.088 |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | 0.039 | | 0.09 | | 0.18 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | **8.6** | | **12** | | **14** |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | 0.65 | | 1.3 | | 1.4 |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | 9.3 | | 13 | | 16 |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location Group | Site | Site | Site | Site | Site | Site |
| | | | | Location ID | SED7.5E | SED7A | SED7A | SED7B | SED7B | SED7B |
| | | | | Sample ID | SED7.5E00N | SED7A00EN | SED7A00N | SED7B00EN | SED7B00N | SED7B00R |
| | | | | Sample Type Code | N | N | N | N | N | FD |
| | | | | Sample Date | 11/25/2013 | 6/9/2017 | 11/13/2013 | 6/7/2017 | 11/13/2013 | 11/13/2013 |
| | | | | Task Code | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | 2.06E-05 | | 3.14E-05 | 3.84E-06 J | 6.8E-06 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | 1.54E-04 | | 6.10E-05 | 2.09E-05 | 3.65E-05 J |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | 1.44E-06 J | | 1.03E-06 J | 5.35E-07 JN | 7.67E-07 JN |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | 1.64E-06 J | | 1.46E-06 J | 7.5E-07 JN | 9.2E-07 JN |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | 1.99E-06 J | | 7.02E-07 JN | 3.05E-07 JN | 5.35E-07 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | 1.49E-06 J | | 2.84E-06 | 1.46E-06 JN | 2.56E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | 4.44E-06 | | 2.60E-06 | 8.91E-07 JN | 1.52E-06 JN |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | 7.65E-08 JN | | 1.29E-07 J | 5.9E-08 J | 8.71E-08 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | 4.52E-06 | | 1.67E-06 J | 7.83E-07 J | 1.25E-06 J |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | 5.68E-07 J | | 6.27E-07 J | 2.33E-07 JN | 2.78E-07 JN |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | 1.08E-06 J | | 5.45E-07 J | 4.23E-07 JN | 4.62E-07 JN |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | 2.41E-06 | | 4.15E-06 | 5.09E-07 JN | 8.06E-07 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | 2.85E-06 JN | | 8.2E-06 J | 4.9E-07 JN | 5.82E-07 JN |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | 1.10E-06 | | 1.43E-06 | 5.27E-07 JN | 6.19E-07 JN |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | 2.86E-07 JN | | 5.97E-07 | 1.94E-08 U | 2.27E-08 U |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | 5.81E-05 | | 3.59E-05 | 7.01E-06 J | 1.62E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | 4.44E-03 | | 2.55E-03 | 6.28E-04 | 9.27E-04 |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 15000 | 12000 | 5900 | 11000 | 8900 | 9300 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 1 J- | 1.5 | 0.43 J- | 0.83 | 0.28 J- | 0.23 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 17 J- | 6.8 | 2.2 J- | 5.5 | 4.2 J- | 3.8 J- |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **150 J-** | **120** | **62** | **120** | **92** | **92** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 2.2 | 1.8 | 0.83 | 1.5 | 1.2 | 1.3 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 32 J- | 26 | 12 | 18 | 13 | 13 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 230 J- | 590 | 270 | 370 | 260 | 270 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | **150 J-** | 45 | 21 | 32 | 22 | 22 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.63 | 0.24 | 0.13 | 0.23 | 0.27 | 0.27 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 360 J+ | 50 | 22 | 42 | 38 | 37 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | | 0.0012 U | | 0.0011 U | 0.00071 UJ | 0.0036 J |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | **1.9** | 0.067 | 0.023 | 0.47 | 0.5 | 0.48 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | **11.8** | | | | | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | **0.082 J** | 0.28 U |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | 0.14 U | **0.065 J** |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.36 | | 0.29 | | 0.2 | 0.24 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.31 | | 0.37 | | 0.2 * | 0.24 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.5 | | 0.62 | | 0.23 * | 0.36 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.14 | | 0.19 | | 0.088 * | 0.096 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | | | | **0.8** | **0.86** |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.49 | | 0.55 | | 0.3 | 0.36 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | 0.055 | | **0.11** | | 0.031 * | 0.057 U |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | | | | 0.14 U* | 0.28 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | 0.23 | | **0.41** | | 0.13 * | 0.18 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | 3.9 | | 4.4 | | 2.2 | 2.6 |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | 0.014 J | | 0.39 | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | 0.03 | | 0.3 | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | **9.6** | | **7.7** | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | 0.79 | | 1.7 | | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | 10 | | 9.4 | | |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location Group | Site | Site | Site | Site | Site | Site |
| | | | | Location ID | SED7D | SED7D | SED7E | SED7E | SED7E | SED7F |
| | | | | Sample ID | SED7D00EN | SED7D00N | SED7E00AN | SED7E00EN | SED7E00N | SED7F00EN |
| | | | | Sample Type Code | N | N | N | N | N | N |
| | | | | Sample Date | 6/9/2017 | 11/25/2013 | 6/22/2017 | 6/8/2017 | 11/25/2013 | 6/8/2017 |
| | | | | Task Code | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside |
| | | | | Depth Interval | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | 5.1E-05 | | | 6.11E-05 | | 4.92E-05 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | 2.54E-04 | | | 2.04E-04 | | 1.66E-04 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | 5.20E-06 | | | 6.20E-06 | | 5.58E-06 |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | 8.71E-06 | | | 1.14E-05 | | 9.35E-06 |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | 9.60E-06 | | | 1.04E-05 | | 1.06E-05 |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | 1.00E-05 | | | 1.20E-05 | | 1.05E-05 |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | 2.01E-05 | | | 2.11E-05 | | 1.90E-05 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | 9.61E-07 J | | | 1.95E-06 | | 8.42E-07 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | 1.65E-05 | | | 1.73E-05 | | 1.51E-05 |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | 4.54E-06 J | | | 6.09E-06 J | | 4.99E-06 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | 8.79E-06 | | | 1.01E-05 | | 9.72E-06 |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | 1.39E-05 | | | 1.89E-05 | | 1.48E-05 |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | 1.37E-05 J | | | 2.27E-05 J | | 1.48E-05 J |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | 3.93E-06 | | | 5.06E-06 | | 3.56E-06 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | 1.65E-06 | | | 1.93E-06 | | 1.60E-06 |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | 8.72E-05 | | | 8.21E-05 | | 6.25E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | 4.37E-03 | | | 1.57E-03 | | 1.39E-03 |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 10000 | 7300 | 3700 | 4000 | 4500 | 7500 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 1.1 | 0.69 J- | 1.4 J | 1.1 | 1.2 J- | **43** |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 5.7 | 4.3 J- | 5.6 J | 5.1 | 4.6 J- | 7.2 |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **97** | **110 J-** | 54 | 52 | **72 J-** | **87** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 1.4 | 1 | 0.54 | 0.51 | 0.71 | 1 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 19 | 16 J- | 4.9 | 9.3 | 13 J- | 14 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 270 | 180 J- | 86 | 100 | 120 J- | 200 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 46 | **50 J-** | 38 J | **56** | **120 J-** | **75** |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.24 | 0.25 | 0.14 | 0.13 | 0.15 | 0.2 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 56 | 110 J+ | 94 J | 110 | 150 J+ | 140 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.001 U | | | 0.00073 U | | 0.00096 U |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.053 | 0.62 | **0.79** | 0.63 | **0.96** | 0.3 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | **0.98** | | | **1** |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | | 0.48 | 0.55 | | 0.49 | |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | | 0.54 | 0.44 | | 0.52 | |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | | 0.86 | 0.65 | | 0.85 | |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | | 0.19 | 0.22 | | 0.27 | |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | | | | | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | | 0.63 | 0.62 | | 0.76 | |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | | 0.086 J | 0.084 | | 0.094 J | |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | | **0.37** | 0.26 | | **0.38** | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | | 5.4 | 5.1 | | 6 | |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | 0.029 | | | 0.075 | 0.111 | 0.06 |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | 0.058 | | | 0.13 | 0.192 | 0.13 |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **12** | | | **11** | **9.85** | **11** |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 0.74 | | | 1.2 | 1.29 | 1.1 |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | 13 | | | 12 | 11.1 | 12 |

# Attachment I Table 1
## Sediment Sample-by-Sample Screen

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED7F | SED7G | SED8.5B | SED8A | SED8A | SED8B |
| | | | | Sample ID | SED7F00N | SED7G00N | SED8.5B00N | SED8A00EN | SED8A00N | SED8B00EN |
| | | | | Sample Type Code | N | N | N | N | N | N |
| | | | | Sample Date | 11/25/2013 | 1/30/2014 | 11/13/2013 | 6/9/2017 | 11/13/2013 | 6/9/2017 |
| | | | | Task Code | Phase2-2013 | Phase2-2013 | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | WP#3-2017 Waterside |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.33 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | 1.08E-03 | 1.83E-05 JN | | 6.98E-06 | | 1.35E-05 |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | 0.0041 J | 4.89E-05 | | 6.17E-05 | | 8.56E-05 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | 0.000151 JN | 1.77E-06 J | | 5.43E-07 J | | 8.59E-07 J |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | 0.00047 JN | 2.39E-06 J | | 7.05E-07 J | | 1.13E-06 J |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | 2.89E-04 | 2.47E-06 J | | 7.91E-07 J | | 1.24E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | 0.000272 JN | 3.65E-06 JN | | 5.87E-07 J | | 1.1E-06 J |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | 5.48E-04 | 4.11E-06 J | | 1.87E-06 J | | 2.76E-06 |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | 2.43E-05 J | 2.97E-07 U | | 1.86E-07 U | | 5.83E-08 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | 0.000705 J | 6.05E-06 | | 1.65E-06 JN | | 2.68E-06 |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | 1.24E-04 | 9.72E-07 J | | 2.15E-07 J | | 3.86E-07 J |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | 0.000277 JN | 6.9E-06 JN | | 5.62E-07 J | | 7.13E-07 J |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | 2.85E-04 | 3.05E-06 J | | 9.07E-07 JN | | 1.57E-06 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | 2.17E-04 | 2.18E-06 J | | 1.23E-06 J | | 2.04E-06 J |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | 5.67E-05 | 9E-07 J | | 4.59E-07 J | | 8.26E-07 JN |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | 3.82E-05 | 5.2E-07 U | | 1.31E-07 U | | 2.07E-07 J |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | 0.001 JN | 2.18E-05 | | 1.77E-05 | | 3.11E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | 1.47E-02 | 3.41E-04 | | 1.72E-03 | | 2.81E-03 |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 7300 | 2400 | 7700 | 12000 | 9700 | 11000 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 2.8 J- | 0.38 | 0.45 J- | 1.1 | 0.55 J- | 1 |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 11 J- | 2.5 | 2.6 J- | 5.9 | 2.9 J- | 5.3 |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **100** | 17 | **84** | **120** | **99** | **100** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.95 | 0.15 | 1.1 | 1.7 | 1.4 | 1.5 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 13 | 7.1 | 16 | 20 | 19 | 20 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 200 | 120 | 370 | 420 | 360 | 390 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | **160 J-** | **84** | 29 | 38 | 34 | 36 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.13 J- | 0.037 J | 0.19 | 0.26 | 0.24 | 0.23 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 440 | 56 | 28 | 45 | 35 | 41 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | 0.011 J | 0.00091 J | | 0.0011 U | | 0.0018 J |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | **0.77** | 0.23 | 0.11 | 0.059 | 0.16 | 0.033 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | 0.3 U | 0.2 U | | | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | 0.3 U | **0.11 J** | | | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.59 | 0.95 | 0.48 | | 0.53 | |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.6 | 0.89 | 0.5 | | 0.71 | |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.86 | 1.2 | 0.8 | | 1.1 | |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.3 | 0.43 | 0.41 | | 0.33 | |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | 0.59 J | 0.55 | | | | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.89 | 1.2 | 0.82 | | 1 | |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | **0.16** | **0.15** | **0.13** | | **0.17** | |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | 0.3 U | **0.15 J** | | | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.51** | **0.64** | **0.53** | | **0.67** | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | **7** | **11** | 6.3 | | **7.8** | |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | 0.171 | | | 0.014 J | | 0.0089 J |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | 0.296 | | | 0.031 | | 0.016 J |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | **19.3** | | | **10** | | **8.3** |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | 2.74 | | | 0.71 | | 0.74 |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | 22.1 | | | 11 | | 9 |

**Attachment I Table 1**
**Sediment Sample-by-Sample Screen**

| | | | | Location Group | Site | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED8B | SED8C | SED8C | SED8C | SED9.5B | SED9A |
| | | | | Sample ID | SED8B00N | SED8C00EN | SED8C00N | SED8C00R | SED9.5B00N | SED9A00N |
| | | | | Sample Type Code | N | N | N | FD | N | N |
| | | | | Sample Date | 11/13/2013 | 6/7/2017 | 11/14/2013 | 11/14/2013 | 11/11/2013 | 11/11/2013 |
| | | | | Task Code | Phase2-2013 | WP#3-2017 Waterside | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.33 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | | |
| **Dioxins/Furans** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | 2.14E-05 | 7.04E-06 JN | 1.39E-05 JN | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | 1.25E-04 | 3.68E-05 J | 6.46E-05 J | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | 1.77E-06 J | 1.03E-06 JN | 1.31E-06 JN | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | 2.75E-06 | 1.4E-06 JN | 2.47E-06 JN | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | 2.57E-06 | 7.47E-07 J | 1.43E-06 J | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | 2.82E-06 | 2.65E-06 JN | 4.43E-06 JN | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | 5.40E-06 | 2.09E-06 J | 3.56E-06 J | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | 2.42E-07 U | 1.25E-07 J | 1.31E-07 JN | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | 4.83E-06 | 1.92E-06 J | 3.77E-06 J | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | 1.29E-06 J | 5.33E-07 JN | 6.99E-07 JN | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | 1.71E-06 JN | 9.24E-07 JN | 1.55E-06 JN | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | 4.06E-06 | 9.04E-07 JN | 1.46E-06 J | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | 5.56E-06 J | 1E-06 JN | 1.95E-06 JN | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | 1.73E-06 | 7.66E-07 JN | 1.56E-06 | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | 4.97E-07 | 5.02E-08 JN | 5.78E-07 J | | |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | 4.72E-05 | 1.3E-05 JN | 1.92E-05 | | |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | 3.66E-03 | 0.000973 J | 0.00181 J | | |
| **Inorganics/Other** | | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 5500 | 10000 | 6600 | 7700 | 4500 | 8800 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.38 J- | 0.89 | 0.35 J- | 0.31 J- | 0.27 J- | 0.43 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 2 J- | 5.1 | 3 J- | 3.6 J- | 2.1 J- | 3.2 J- |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | **68** | **99** | **63** | **71** | 44 J+ | **88 J+** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.82 | 1.4 | 0.85 | 1 | 0.67 | 1.1 |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 12 | 18 | 14 | 16 | 9.1 J | 12 J |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 290 | 350 | 280 | 330 | 140 | 310 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 21 | 35 | 25 | 28 | 15 | 19 |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.14 | 0.22 | 0.16 J- | 0.18 J- | 0.12 | 0.2 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 23 | 39 | 29 | 36 | 25 J+ | 35 J+ |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | | |
| **Pesticides and PCBs** | | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | | 0.0011 U | 0.0055 J | 0.00084 UJ | | |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.1 | 0.26 | 0.59 | 0.41 | 0.38 | 0.074 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | 0.17 | |
| **SVOCs** | | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | | 0.15 U | 0.33 U | | |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | | 0.15 U | 0.33 U | | |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.33 | | 0.32 | 0.45 | 0.45 | 0.48 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.42 | | 0.39 | 0.63 | 0.54 | 0.59 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.73 | | 0.24 J | 0.92 J | 0.88 | 0.83 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.28 | | 0.57 | 0.41 | 0.2 | 0.33 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | | **1.3** | **1.8** | | |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.66 | | 0.53 | 0.75 | 0.79 | 0.77 |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | 0.079 | | 0.031 U | **0.16** | **0.12** | **0.14** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | | 0.15 U | 0.33 U | | |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.43** | | 0.27 J | **0.62 J** | **0.43** | **0.55** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | 4.9 | | 4 | **6.6** | 5.8 | 6.2 |
| **SVOCs (Method ID-0016)** | | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | 0.03 | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | 0.045 | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | **11** | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | 0.77 | | | | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | 12 | | | | |

## Attachment I Table 1
## Sediment Sample-by-Sample Screen

| | | | | Location Group | Site | Site | Site | Site | Site |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Location ID | SED9B | SED9C | WSED1 | WSED1 | WSED2 |
| | | | | Sample ID | SED9B00N | SED9C00N | WSED100N | WSED100R | WSED200N |
| | | | | Sample Type Code | N | N | N | FD | N |
| | | | | Sample Date | 11/11/2013 | 11/11/2013 | 11/15/2013 | 11/15/2013 | 11/15/2013 |
| | | | | Task Code | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 | Phase2-2013 |
| | | | | Depth Interval | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft | 0 - 0.5 ft |
| Chemical | CAS | BTV (a) | PEC | Units | | | | | |
| **Dioxins/Furans** | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | 4.7E-05 | | mg/kg | | 2.73E-06 J | 2.9E-05 J | 1.16E-05 JN | 1.87E-05 JN |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | 3.8E-04 | | mg/kg | | 1.38E-05 | 0.000136 J | 4E-05 J | 7.52E-05 |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | 3.0E-06 | | mg/kg | | 3.25E-07 JN | 2.82E-06 J | 7.25E-07 JN | 1.58E-06 JN |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | 7.2E-06 | | mg/kg | | 3.51E-07 JN | 7.4E-06 J | 1.34E-06 JN | 2.54E-06 JN |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | 4.8E-06 | | mg/kg | | 3.93E-07 JN | 3.67E-06 J | 9.59E-07 JN | 1.97E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | 3.3E-06 | | mg/kg | | 5.55E-07 JN | 6.2E-06 JN | 1.81E-06 JN | 3.55E-06 JN |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | 1.4E-05 | | mg/kg | | 6.53E-07 JN | 8.47E-06 J | 2.09E-06 J | 3.64E-06 J |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | NC | | mg/kg | | 2.1E-08 U | 5.01E-07 J | 8.49E-08 JN | 3.01E-07 JN |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | 1.5E-05 | | mg/kg | | 8.78E-07 JN | 1.02E-05 J | 2.47E-06 J | 3.96E-06 J |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | 1.8E-06 | | mg/kg | | 1.13E-07 JN | 2.26E-06 JN | 5.23E-07 JN | 1.25E-06 JN |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | 2.2E-06 | | mg/kg | | 5.09E-07 JN | 4.53E-06 JN | 7.58E-07 J | 1.65E-06 JN |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | 3.8E-06 | | mg/kg | | 3.39E-07 JN | 4.02E-06 J | 9.24E-07 JN | 1.89E-06 J |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | 2.6E-06 | | mg/kg | | 3.45E-07 J | 4.93E-06 J | 9.66E-07 J | 2.33E-06 JN |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | 3.1E-06 | | mg/kg | | 1.27E-07 JN | 3.07E-06 J | 6.99E-07 J | 1.96E-06 JN |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | 6.8E-07 | | mg/kg | | 1.5E-08 U | 1.05E-06 JN | 2.75E-07 JN | 4.15E-08 U |
| Octachlorochlorodibenzofuran | 39001-02-0 | 9.2E-05 | | mg/kg | | 4.21E-06 J | 3.96E-05 JN | 1.46E-05 JN | 2.36E-05 |
| Octachlorochlorodibenzo-p-dioxin | 3268-87-9 | 1.3E-02 | | mg/kg | | 3.38E-04 | 0.00382 J | 0.000902 J | 1.80E-03 |
| **Inorganics/Other** | | | | | | | | | |
| Aluminum | 7429-90-5 | 15034 | 58000 | mg/kg | 5600 | 6300 | 7900 | 6100 | 8700 |
| Antimony | 7440-36-0 | 0.92 | **3** | mg/kg | 0.31 J- | 0.48 J- | 0.44 J- | 0.59 J- | 0.74 J- |
| Arsenic | 7440-38-2 | 4.9 | 33 | mg/kg | 3.3 J- | 2.5 J- | 3 | 2.4 | 4 J- |
| Barium | 7440-39-3 | 107 | **60** | mg/kg | 57 J+ | **66 J+** | **89** | **71** | **97** |
| Beryllium | 7440-41-7 | 1.6 | | mg/kg | 0.83 | 0.91 | 1 | 0.94 | 1.3 J |
| Cobalt | 7440-48-4 | 21 | | mg/kg | 8.4 J | 12 J | 14 | 16 | 22 |
| Manganese | 7439-96-5 | 436 | 1100 | mg/kg | 240 | 230 | 260 | 240 | 310 |
| Nickel | 7440-02-0 | 40 | **48.6** | mg/kg | 16 | 20 | 32 | 29 | 39 J- |
| Thallium | 7440-28-0 | 0.31 | | mg/kg | 0.12 | 0.16 | 0.17 | 0.18 | 0.26 |
| Vanadium | 7440-62-2 | 43 | | mg/kg | 35 J+ | 29 J+ | 36 | 25 | 37 |
| Cyanide | 57-12-5 | 990 | **100** | ug/kg | | | | | |
| **Pesticides and PCBs** | | | | | | | | | |
| 4,4'-DDT | 50-29-3 | 2.8E-03 | **0.0629** | mg/kg | | 0.0025 J | 0.004 J | 0.0048 J | 0.0072 J |
| Chlordane (Technical) | 12789-03-6 | 0.12 | **0.0176** | mg/kg | | | | | |
| PCB, Total Aroclors | TOT-PCB-ARO-C | 0.18 | **0.676** | mg/kg | 0.18 | 0.17 | 0.33 | 0.12 | 0.17 |
| PCB, Total Congeners | TOT-PCB-Cong | 0.42 | **0.676** | mg/kg | | | | | |
| **SVOCs** | | | | | | | | | |
| 4-Chloroaniline | 106-47-8 | | **0.021** | mg/kg | | 0.32 U | **0.057 J** | 0.33 U | 0.52 U |
| 4-Methylphenol | 106-44-5 | | **0.0051** | mg/kg | | 0.32 U | **0.11 J** | 0.33 U | 0.52 U |
| Benzo(a)anthracene | 56-55-3 | 1.6 | **1.05** | mg/kg | 0.4 | 0.48 | 0.26 J | 1 J | 0.69 |
| Benzo(a)pyrene | 50-32-8 | 1.7 | **1.45** | mg/kg | 0.47 | 0.62 | 0.25 J | 1.1 J | 0.79 |
| Benzo(b)fluoranthene | 205-99-2 | 2.3 | **2.23** | mg/kg | 0.76 | 0.99 | 0.43 J | 1.8 J | 1.5 |
| Benzo(k)fluoranthene | 207-08-9 | 0.93 | 13.4 | mg/kg | 0.25 | 0.29 | 0.089 J | 0.5 J | 0.5 |
| Benzoic acid | 65-85-0 | | 2 | mg/kg | | | | | |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 2.3 | **0.75** | mg/kg | | **1.5** | **1.6** | **1.3** | **1.5** |
| Chrysene | 218-01-9 | 1.8 | **1.29** | mg/kg | 0.7 | 0.88 | 0.4 J | **1.4 J** | **1.3** |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | **0.1** | mg/kg | 0.089 | **0.14** | 0.051 U | **0.12** | **0.15** |
| Di-n-octylphthalate | 117-84-0 | | **0.1** | mg/kg | | 0.32 U | 0.25 U | **0.24 J** | 0.52 U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 1.4 | **0.33** | mg/kg | **0.41** | **0.57** | 0.12 J | **0.44 J** | **0.38** |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 19 | **6.5** | mg/kg | 5.3 | **6.8** | 2.9 | **11** | **8.8** |
| **SVOCs (Method ID-0016)** | | | | | | | | | |
| 2,3,5-Trimethylnaphthalene | 2245-38-7 | 0.028 | | mg/kg | | | | | |
| 2,6-Dimethylnaphthalene | 581-42-0 | 0.035 | | mg/kg | | | | | |
| Total High-molecular-weight PAHs | TOT-PAH-HMW | 17 | **6.5** | mg/kg | | | | | |
| Total Low-molecular-weight PAHs | TOT-PAH-LMW | | 5.3 | mg/kg | | | | | |
| Total PAHs (sum 16) | TOT-PAH | | **22.8** | mg/kg | | | | | |

## Attachment I Table 2
## Porewater Sample-by-Sample Screen

| | | Site Samples | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Area** | **Site - Cove** | **Site - Cove** | **Site - Cove** | **Site - Cove** | **Site - Cove** | **Site - Cove** | **Site - Cove** | **Site - Channel** |
| | **Location ID** | **SED6.5D** | **SED6.5E** | **SED7.5D** | **SED7.5E** | **SED7D** | **SED7E** | **SED7F** | **SED6A** |
| | **Sample ID** | **PW6.5D00EN** | **PW6.5E00EN** | **PW7.5D00EN** | **PW7.5E00EN** | **PW7D00EN** | **PW7E00EN** | **PW7F00EN** | **PW6A00EN** |
| | **Sample Date** | **6/9/2017** | **6/8/2017** | **6/9/2017** | **6/8/2017** | **6/9/2017** | **6/8/2017** | **6/8/2017** | **6/8/2017** |
| | **Sample Type** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** |
| **Detected Analyte** | **Chronic ESV (a)** | | | | | | | | |
| **Metals - Dissolved Phase** | | | | | | | | | |
| Barium | **4** | **92** | **90** | **92** | **120** | **79** | **99** | **90** | **130** |
| Iron | **1000** | **6700** | **7200** | **6700** | **5700** | **7300** | **7200** | **6100** | **61000** |
| Manganese | **120** | **1800** | **2300** | **1800** | **1300** | **1800** | **1400** | **2500** | **9000** |
| **Metals - Total Phase** | | | | | | | | | |
| Iron | **300** | **21000** | **26000** | **26000** | **18000** | **13000** | **19000** | **27000** | **100000** |
| **Semi-volatile Organic Compounds** | | | | | | | | | |
| Pyrene | **0.025** | 0.02 J | **0.03 J** | **0.03 J** | **0.03 J** | **0.03 J** | 0.02 J | 0.02 J | 0.02 J |

Notes:
All concentrations reported in micrograms per liter (ug/l).
Yellow highlighted cells indicate concentrations that are greater than the chronic ESV.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
FD - Field duplicate.
N - Normal sample.
NV - No ESV or Effects-based ESV Available.
J - Estimated value.
PAH - Polycyclic Aromatic Hydrocarbon.
U - Not detected.
USEPA - United States Environmental Protection Agency.
WQS - Water Quality Standards.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DOEE WQS (DOEE, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and other literature values (Suter and Tsao 1996, Buchman 2008).

## Attachment I Table 2
## Porewater Sample-by-Sample Screen

| | | Site Samples | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Area** | **Site - Channel** | **Site - Channel** | **Site - Channel** | **Site - Channel** | **Site - Channel** | **Site - Channel** | **Site - Channel** |
| | **Location ID** | **SED6B** | **SED6C** | **SED7A** | **SED7B** | **SED8A** | **SED8B** | **SED8C** |
| | **Sample ID** | **PW6B00EN** | **PW6C00EN** | **PW7A00EN** | **PW7B00EN** | **PW8A00EN** | **PW8B00EN** | **PW8C00EN** |
| | **Sample Date** | **6/8/2017** | **6/7/2017** | **6/9/2017** | **6/7/2017** | **6/9/2017** | **6/9/2017** | **6/7/2017** |
| | **Sample Type** | **N** | **N** | **N** | **N** | **N** | **N** | **N** |
| **Detected Analyte** | **Chronic ESV (a)** | | | | | | | |
| **Metals - Dissolved Phase** | | | | | | | | |
| Barium | **4** | **98** | **74** | **180** | **85** | **110** | **180** | **74** |
| Iron | **1000** | **17000** | **4400** | **67000** | **4700** | **17000** | **53000** | **7600** |
| Manganese | **120** | **7100** | **4100** | **11000** | **2800** | **5500** | **9500** | **3300** |
| **Metals - Total Phase** | | | | | | | | |
| Iron | **300** | **66000** | **30000** | **110000** | **28000** | **61000** | **98000** | **22000** |
| **Semi-volatile Organic Compounds** | | | | | | | | |
| Pyrene | **0.025** | 0.02 J | **0.04 J** | 0.02 J | **0.12 J** | 0.02 J | 0.02 J | 0.03 J |

Notes:
All concentrations reported in micrograms per liter (ug/l).
Yellow highlighted cells indicate concentrations that are greater than the chronic ESV.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
FD - Field duplicate.
N - Normal sample.
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J - Estimated value.
PAH - Polycyclic Aromatic Hydrocarbon.
U - Not detected.
USEPA - United States Environmental Protection Agency.
WQS - Water Quality Standards.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DOEE WQS (DOEE, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and other literature values (Suter and Tsao 1996, Buchman 2008).

## Attachment I Table 2
## Porewater Sample-by-Sample Screen

| | | Reference Samples | | | | | |
|---|---|---|---|---|---|---|---|
| | Area | Reference | Reference | Reference | Reference | Reference | Reference |
| | Location ID | SEDBACK16 | SEDBACK17 | SEDBACK18 | SEDBACK19 | SEDBACK19 | SEDBACK20 |
| | Sample ID | PWBACK1600N | PWBACK1700N | PWBACK1800N | PWBACK1900N | PWBACK1900R | PWBACK2000N |
| | Sample Date | 6/12/2017 | 6/12/2017 | 6/12/2017 | 6/13/2017 | 6/13/2017 | 6/13/2017 |
| | Sample Type | N | N | N | N | FD | N |
| **Detected Analyte** | **Chronic ESV (a)** | | | | | | |
| **Metals - Dissolved Phase** | | | | | | | |
| Barium | **4** | **340** | **300** | **220** | **310** | **240** | **280** |
| Iron | **1000** | **26000** | **45000** | **10000** | 210 | 240 | **38000** |
| Manganese | **120** | **9600** | **7600** | **3800** | **2700** | **2800** | **6900** |
| **Metals - Total Phase** | | | | | | | |
| Iron | **300** | **52000** | **65000** | **25000** | **33000 J** | **14000 J** | **49000 J** |
| **Semi-volatile Organic Compounds** | | | | | | | |
| Pyrene | **0.025** | 0.01 J | 0.01 J | 0.02 J | 0.02 J | 0.02 J | **0.03 J** |

Notes:
All concentrations reported in micrograms per liter (ug/l).
Yellow highlighted cells indicate concentrations that are greater than the chronic ESV.
< - Result not detected above laboratory reporting limit.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
ESV - Ecological Screening Value.
FD - Field duplicate.
N - Normal sample.
NV - No ESV or Effects-based ESV Available.
J - Estimated value.
PAH - Polycyclic Aromatic Hydrocarbon.
U - Not detected.
USEPA - United States Environmental Protection Agency.
WQS - Water Quality Standards.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DOEE WQS (DOEE, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and other literature values (Suter and Tsao 1996, Buchman 2008).

# Attachment J

# Food Web Model

**Attachment J**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

**Table of Contents**

**Attachment J Table 1**
**Wildlife Exposure Factors**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| Receptor Species | Body Weight (kg) | Assumed Diet: Fraction of diet as %; Amount as $kg_{ww}$/day — Units | Invertebrates | Fish | Food Ingestion Rate ($kg_{dw}$/day) | Food Ingestion Rate ($kg_{ww}$/day) | Fraction Sediment in Diet (%) Amount as $kg_{dw}$/day | Home Range (ha) | Exposure Duration (unitless) |
|---|---|---|---|---|---|---|---|---|---|
| **Piscivores** | | | | | | | | | |
| Great Blue Heron (*Ardea herodias*) | 2.336 (a) | %<br>$kg_{ww}$/day | 6%<br>0.036 (b) | 94%<br>0.546 (b) | 0.145 (c) | 0.583 (d) | 5%<br>0.007 (e) | 4.5 (f) | 1 (g) |
| Belted kingfisher (*Megaceryle alcyon*) | 0.147 (a) | %<br>$kg_{ww}$/day | -- (b)<br>-- | 100%<br>0.093 (b) | 0.023 (c) | 0.093 (d) | 2%<br>0.0005 (e) | 1.65 (f) | 1 (g) |
| Raccoon (*Procyon lotor*) | 5.700 (a) | %<br>$kg_{ww}$/day | 9%<br>0.057 (b) | 91%<br>0.553 (b) | 0.152 (c) | 0.611 (d) | 9.4%<br>0.014 (e) | 156 (f) | 1 (g) |

**General Notes:**

Food ingestion rates are wet weight for food items and dry weight for sediment/soil ingestion. As needed, rate may be converted.
Ingested diet and ingested abiotic media (i.e., soil or sediment) total 100% of dietary ingestion.
See individual organism notes for source, units, and conversion.
Moisture content of food items assumed to be as follows: 76% for invertebrates and 75% for fish (USEPA, 1993).

BW - Body Weight.
FIR - Food Ingestion Rate.
COPC - Constituent of Potential Concern.
ha - hectare.
ww - Wet Weight.
dw - Dry Weight.
USEPA - United States Environmental Protection Agency.

Footnotes for individual species parameters and assumptions presented on next pages.

**Attachment J Table 1**
**Wildlife Exposure Factors**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

**Notes for Great Blue Heron (*Ardea herodias*):**

(a) Average body weight of adult male and female herons (USEPA, 1993).
(b) Diet is based on the percentage of stomach contents found in birds in a lower Michigan river (USEPA, 1993).
(c) Food ingestion rate calculated using algorithm for carnivorous birds developed by Nagy, 2001 [FIR ($g_{dw}$/day) = 0.849*$BW^{0.663}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Assumption for wading bird based on best professional judgement.
(f) Average feeding territory size based on studies conducted in freshwater marsh and estuary in Oregon (USEPA, 1993).
(g) Great blue heron assumed to be present and actively foraging year-round.

**Notes for Belted Kingfisher (*Megaceryle alcyon*):**

(a) Average body weight of adult male and female kingfishers (USEPA, 1993).
(b) Diet assumed to be exclusively fish based on stomach content and prey item data in streams of Michigan and Nova Scotia (USEPA, 1993).
(c) Food ingestion rate calculated using algorithm for carnivorous birds developed by Nagy, 2001 [FIR ($g_{dw}$/day) = 0.849*$BW^{0.663}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Assumption for kingfisher based on best professional judgement.
(f) Average territory (km shoreline) based on studies conducted in streams in Pennsylvania and Ohio (USEPA, 1993).
(g) Belted kingfisher assumed to be present and actively foraging year-round.

**Notes for Raccoon (*Procyon lotor*):**

(a) Average body weight of adult male and female raccoons in Illinois, Missouri, and Alabama studies (USEPA, 1993).
(b) Diet is based on stomach content data for raccoons in Washington tidewater mudflats (USEPA, 1993).
(c) Food ingestion rate calculated using algorithm for omnivorous mammals developed by Nagy, 2001 [FIR ($g_{dw}$/day) = 0.432*$BW^{0.678}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Value for raccoon soil consumption (Table 4-4; USEPA, 1993).
(f) Mean of home ranges from Michigan study (USEPA, 1993).
(g) Raccoon assumed to be present and actively foraging year-round.

**Attachment J Table 2**
**Sediment and Tissue Concentrations**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | Media Concentrations | | |
|---|---|---|---|
| | Sediment Maximum EPC (a) ($mg/kg_{dw}$) | Fish Tissue Maximum EPC (b) ($mg/kg_{ww}$) | Invertebrate Tissue Maximum EPC (c) ($mg/kg_{ww}$) |
| **INORGANICS** | | | |
| Arsenic | 5.0E+00 | 1.4E-01 | 8.3E-01 |
| Cadmium | 1.7E+00 | 1.2E-02 | 9.4E-02 |
| Chromium | 4.2E+01 | 1.3E+00 | 2.9E+00 |
| Copper | 7.4E+01 | 1.1E+00 | 6.3E+01 |
| Lead | 9.9E+01 | 7.0E-01 | 3.1E+00 |
| Mercury | 2.2E-01 | 3.7E-02 | 4.7E-02 |
| Nickel | 5.2E+01 | 6.3E-01 | 1.8E+00 |
| Selenium | 1.0E+00 | 3.5E-01 | 5.1E-01 |
| Silver | 7.9E-01 | 4.5E-03 | 5.7E-01 |
| Zinc | 2.4E+02 | 3.4E+01 | 7.6E+01 |
| **PESTICIDES** | | | |
| 4,4'-DDD | 1.2E-02 | 7.0E-03 | 2.0E-03 |
| 4,4'-DDE | 1.1E-02 | 1.7E-02 | 4.6E-03 |
| 4,4'-DDT | 1.7E-01 | 4.8E-03 | 3.3E-03 |
| Aldrin | 7.6E-04 | 1.4E-03 | 1.4E-04 |
| alpha-BHC | 2.4E-04 | 8.1E-04 | 1.3E-04 |
| beta-BHC | 9.8E-03 | 7.8E-04 | 4.1E-04 |
| Chlordane | 6.8E-02 | 1.3E-01 | 3.2E-02 |
| delta-BHC | 8.4E-03 | 1.4E-03 | 7.4E-04 |
| Dieldrin | 4.9E-03 | 6.6E-03 | 1.5E-03 |
| Endrin | 7.4E-03 | 4.9E-03 | 1.2E-03 |
| Endosulfan II | 6.4E-03 | 1.7E-03 | 6.2E-04 |
| gamma-BHC (Lindane) | 6.8E-03 | 2.1E-03 | 9.0E-04 |
| Heptachlor | 2.6E-03 | 7.6E-04 | 1.7E-04 |
| Heptachlor Epoxide | 2.2E-03 | 4.0E-03 | 2.3E-03 |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | |
| PCB, Total Aroclors | 4.8E-01 | 2.6E-01 | 9.0E-02 |
| PCB, Total Congeners | 2.5E+00 | 3.5E-01 | 9.0E-02 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS** | | | |
| Total High-molecular-weight PAHs | 8.6E+00 | 1.2E-01 | 2.7E-01 |
| Total Low-molecular-weight PAHs | 1.3E+00 | 1.7E-02 | 2.3E-02 |

**Attachment J Table 2**
**Sediment and Tissue Concentrations**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | Media Concentrations | | |
|---|---|---|---|
| | Sediment Maximum EPC (a) (mg/$kg_{dw}$) | Fish Tissue Maximum EPC (b) (mg/$kg_{ww}$) | Invertebrate Tissue Maximum EPC (c) (mg/$kg_{ww}$) |
| **DIOXIN/FURANS** | | | |
| TCDD TEQ Bird | 1.5E-04 | 1.5E-06 | 1.5E-06 |
| TCDD TEQ Mammal | NV | 9.5E-07 | 8.4E-07 |

Notes:
Maximum EPCs are the recommended upper confidence limit (UCL) on the arithmetic mean (or the maximum detected concentration if a UCL could not be calculated).

COPC - Constituent of Potential Concern.
dw - Dry weight.
EPC - Exposure Point Concentration.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
ww - Wet weight.
TCDD TEQ - Tetrachlorodibenzodioxin Toxic Equivalent.

(a) Sediment EPCs presented in Attachment B. Site-specific data collected from surface sediments between 2013 and 2017.
(b) Fish EPCs presented in Attachment B. Forage fish and mid- trophic level fish samples were collected from Exposure Unit 3 and Kingman Lake of the Anacostia River Sediment Project (DOEE, 2018).
(c) Benthic invertebrate EPCs presented in Attachment B. Snail, clam, and crayfish tissue data were collected from Exposure Unit 3 of the Anacostia River Sediment Project (DOEE, 2018).

**Attachment J Table 3**
**Wildlife Toxicity Reference Values**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| COPC | Source | Target Species | NOAEL-based TRVs: NOAEL ($mg/kg_{bw}/day$) | NOAEL-based TRVs: NOAEL Test Endpoint | LOAEL-based TRVs: Test LOAEL ($mg/kg_{bw}/day$) | LOAEL-based TRVs: LOAEL Test Endpoint |
|---|---|---|---|---|---|---|
| **INORGANICS** | | | | | | |
| Arsenic | (a) | Mammal | 1.04 | Growth | 1.66 | Growth |
| | (a) | Bird | 2.24 | Growth | 17.3 | Growth |
| Cadmium | (a) | Mammal | 0.77 | Growth | 7.7 | Growth |
| | (a) | Bird | 1.47 | Reproduction and growth | 6.35 | Reproduction and growth |
| Chromium | (c) | Mammal | 9.2 | Reproduction and growth | NV | NV |
| | (c,b) | Bird | 2.7 | Reproduction and growth | 5.0 | Reproduction and growth |
| Copper | (a) | Mammal | 5.6 | Growth | 9.34 | Growth |
| | (a) | Bird | 4.05 | Reproduction | 12.1 | Reproduction |
| Lead | (a) | Mammal | 4.7 | Growth | 8.9 | Growth |
| | (a) | Bird | 1.63 | Reproduction and growth | 3.26 | Reproduction and growth |
| Mercury | (c) | Mammal | 0.09 | Reproduction | 0.42 | Reproduction |
| | (c) | Bird | 0.024 | Reproduction | 0.078 | Reproduction |
| Nickel | (a) | Mammal | 1.7 | Reproduction | 3.4 | Reproduction |
| | (a) | Bird | 6.71 | Reproduction and growth | 18.6 | Reproduction and growth |
| Selenium | (a) | Mammal | 0.143 | Growth | 0.215 | Growth |
| | (a) | Bird | 0.290 | Mortality | 0.579 | Mortality |
| Silver | (a) | Mammal | 6.02 | Growth | 60.2 | Growth |
| | (a) | Bird | 2.02 | Growth | 20.2 | Growth |
| Zinc | (a) | Mammal | 75.4 | Reproduction and growth | 298 | Reproduction and growth |
| | (a) | Bird | 66.1 | Reproduction and growth | 187 | Reproduction and growth |
| **PESTICIDES** | | | | | | |
| 4,4'-DDD | (a) | Mammal | 0.147 | Reproduction | 0.735 | Reproduction |
| | (a) | Bird | 0.227 | Growth | 2.27 | Growth |
| 4,4'-DDE | (a) | Mammal | 0.147 | Reproduction | 0.735 | Reproduction |
| | (a) | Bird | 0.227 | Growth | 2.27 | Growth |
| 4,4'-DDT | (a) | Mammal | 0.147 | Reproduction | 0.735 | Reproduction |
| | (a) | Bird | 0.227 | Growth | 2.27 | Growth |
| Aldrin | (b) | Mammal | 0.2 | Reproduction | 0.8 | Reproduction |
| | (d) | Bird | NV | NV | NV | NV |
| alpha-BHC | (b,g) | Mammal | 1.6 | Reproduction | 3.2 | Reproduction |
| | (b) | Bird | 0.563 | Reproduction | 2.25 | Reproduction |
| beta-BHC | (b) | Mammal | 0.4 | Reproduction | 2.0 | Reproduction |
| | (b) | Bird | 0.563 | Reproduction | 2.25 | Reproduction |
| Chlordane | (b) | Mammal | 4.6 | Reproduction | 9.2 | Reproduction |
| | (b) | Bird | 2.14 | Reproduction | 10.7 | Reproduction |
| delta-BHC | (b,g) | Mammal | 1.6 | Reproduction | 3.2 | Reproduction |
| | (b) | Bird | 0.563 | Reproduction | 2.25 | Reproduction |
| Dieldrin | (a) | Mammal | 0.015 | Reproduction | 0.030 | Reproduction |
| | (a) | Bird | 0.071 | Growth | 3.78 | Growth |
| Endosulfan II | (b) | Mammal | 0.15 | Reproduction | NV | NV |
| | (b) | Bird | 10.0 | Reproduction | NV | NV |
| Endrin | (b) | Mammal | 0.092 | Reproduction | 0.92 | Reproduction |
| | (b) | Bird | 0.30 | Reproduction | 1.2 | Reproduction |

**Attachment J Table 3**
**Wildlife Toxicity Reference Values**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | | NOAEL-based TRVs | | LOAEL-based TRVs | |
|---|---|---|---|---|---|---|
| **COPC** | **Source** | **Target Species** | **NOAEL (mg/kg$_{bw}$/day)** | **NOAEL Test Endpoint** | **Test LOAEL (mg/kg$_{bw}$/day)** | **LOAEL Test Endpoint** |
| gamma-BHC (Lindane) | (e) | Mammal | 0.050 | Reproduction | 3.75 | Reproduction |
| | (b) | Bird | 2.0 | Reproduction | 20 | Redproduction |
| Heptachlor | (e) | Mammal | 0.13 | Reproduction | 6.8 | Reproduction |
| | (b, f) | Bird | 2.1 | Reproduction | 10.7 | Reproduction |
| Heptachlor Epoxide | (b) | Mammal | 0.1 | Reproduction | 1.0 | Reproduction |
| | (b, f) | Bird | 2.1 | Reproduction | 10.7 | Reproduction |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | |
| PCB, Total Aroclors | (b) | Mammal | 0.14 | Reproduction | 0.69 | Reproduction |
| | (c) | Bird | 1.8 | Reproduction | 7.2 | Reproduction |
| PCB, Total Congeners | (c) | Mammal | 1.8 | Reproduction | 7.2 | Reproduction |
| | (c) | Bird | 0.25 | Reproduction | 2.5 | Reproduction |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | |
| Total High-molecular-weight PAHs | (a) | Mammal | 0.615 | Mortality | 3.07 | Mortality |
| | (c) | Bird | 40 | Reproduction | 160 | Reproduction |
| Total Low-molecular-weight PAHs | (a) | Mammal | 65.6 | Growth | 328 | Growth |
| | (c) | Bird | 40 | Reproduction | 160 | Reproduction |
| **DIOXIN/FURANs** | | | | | | |
| 2,3,7,8-TCDD | (b) | Mammal | 0.0000010 | Reproduction | 0.000010 | Reproduction |
| | (b) | Bird | 0.000014 | Reproduction | 0.00014 | Reproduction |

Notes:
BW - Body Weight.
COPC - Constituent of Potential Concern.
LOAEL - Lowest Observed Adverse Effects Level.
NOAEL - No Observed Adverse Effects Level.
NV - No Value.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
TRV - Toxicity Reference Value.

TRV derivations described in Attachment H.
(a) TRVs derived by USEPA during development of Eco-SSLs. See individual Eco-SSL documents for details (https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents). The process for derivation of wildlife TRVs is described in Attachment 4-5 of USEPA (2007).
(b) TRVs derived by Oak Ridge National Laboratory (Sample, et al., 1996).
(c) TRVs derived from other studies. See Attachment H for details.
(d) No appropriate study on avian receptors was found.
(e) Navy. 1998. Development of Toxicity Reference Values for Conducting Ecological Risk Assessment at Naval Facilities in California, Interim Final. Prepared by Naval Facilities Engineering Command, Engineering Field Activity West (EFA West). San Bruno, California.
(f) TRV for Chlordane was used a surrogate.
(g) TRV for Benzene Hexachloride (BHC mixed isomers) was used a surrogate.

**Attachment J Table 4**
**Potential Risks to the Great Blue Heron**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| ASSUMPTIONS FOR THE GREAT BLUE HERON | |
|---|---|
| Body Weight (kg) | 2.336 |
| Exposure Duration | 1 |
| Area Use Factor | 1 |
| Sediment Consumption Rate ($kg_{dw}$/day) | 0.007 |
| Fish Consumption Rate ($kg_{ww}$/day) | 0.546 |
| Invt. Consumption Rate ($kg_{ww}$/day) | 0.036 |

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s]) \times ED \times AUF}{\text{Body Weight}}$$

Where:
$IR_f$ = Ingestion rate of food (kg/day)
$IR_s$ = Incidental ingestion rate of sediment (kg/day)
$C_f$ = Concentration of COPC in food (mg/kg)
$C_s$= Concentration of COPC in sediment or soil (mg/kg)
ED = Exposure duration (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the exposure area to the receptor's home range)

Notes:
BW - Body Weight.
COPC - Constituent of Potential Concern.
dw - Dry Weight.
EPC - Exposure Point Concentration.
HQ - Hazard Quotient (Dose/TRV).
LOAEL - Lowest Observed Adverse Effects Level.
NC - Not Calculated.
NOAEL - No Observed Adverse Effects Level.
NV - No Value.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
TCDD TEQ - Tetrachlorodibenzodioxin Toxic Equivalent.
TRV - Toxicity Reference Value.
ww - Wet Weight.

HQs above 1 are bolded and highlighted.

## SUPPORTING CALCULATIONS

| MAXIMUM EPC | Media Concentrations | | | Potential Daily Dose ($mg/kg_{bw}$/day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sediment | Benthic Invertebrate | Fish | Sediment | Benthic Invertebrate | Fish | | NOAEL-based TRV | | LOAEL-based TRV | |
| **COPC** | **($mg/kg_{dw}$)** | **($mg/kg_{ww}$)** | **($mg/kg_{ww}$)** | | | | **Total** | **($mg/kg_{bw}$/day)** | **NOAEL-based HQ** | **($mg/kg_{bw}$/day)** | **LOAEL-based HQ** |
| **INORGANICS** | | | | | | | | | | | |
| Arsenic | 5.0E+00 | 8.3E-01 | 1.4E-01 | 1.6E-02 | 1.3E-02 | 3.2E-02 | 6.1E-02 | 2.2E+00 | 2.7E-02 | 1.7E+01 | 3.5E-03 |
| Cadmium | 1.7E+00 | 9.4E-02 | 1.2E-02 | 5.2E-03 | 1.5E-03 | 2.9E-03 | 9.6E-03 | 1.5E+00 | 6.5E-03 | 6.4E+00 | 1.5E-03 |
| Chromium | 4.2E+01 | 2.9E+00 | 1.3E+00 | 1.3E-01 | 4.5E-02 | 3.0E-01 | 4.8E-01 | 2.7E+00 | 1.8E-01 | 5.0E+00 | 9.6E-02 |
| Copper | 7.4E+01 | 6.3E+01 | 1.1E+00 | 2.3E-01 | 9.8E-01 | 2.5E-01 | 1.5E+00 | 4.1E+00 | 3.6E-01 | 1.2E+01 | 1.2E-01 |
| Lead | 9.9E+01 | 3.1E+00 | 7.0E-01 | 3.1E-01 | 4.8E-02 | 1.6E-01 | 5.2E-01 | 1.6E+00 | 3.2E-01 | 3.3E+00 | 1.6E-01 |
| Mercury | 2.2E-01 | 4.7E-02 | 3.7E-02 | 6.8E-04 | 7.3E-04 | 8.7E-03 | 1.0E-02 | 2.4E-02 | 4.2E-01 | 7.8E-02 | 1.3E-01 |
| Nickel | 5.2E+01 | 1.8E+00 | 6.3E-01 | 1.6E-01 | 2.8E-02 | 1.5E-01 | 3.4E-01 | 6.7E+00 | 5.0E-02 | 1.9E+01 | 1.8E-02 |
| Selenium | 1.0E+00 | 5.1E-01 | 3.5E-01 | 3.2E-03 | 7.9E-03 | 8.3E-02 | 9.4E-02 | 2.9E-01 | 3.2E-01 | 5.8E-01 | 1.6E-01 |
| Silver | 7.9E-01 | 5.7E-01 | 4.5E-03 | 2.5E-03 | 8.8E-03 | 1.0E-03 | 1.2E-02 | 2.0E+00 | 6.1E-03 | 2.0E+01 | 6.1E-04 |
| Zinc | 2.4E+02 | 7.6E+01 | 3.4E+01 | 7.6E-01 | 1.2E+00 | 7.9E+00 | 9.8E+00 | 6.6E+01 | 1.5E-01 | 1.9E+02 | 5.3E-02 |
| **PESTICIDES** | | | | | | | | | | | |
| 4,4'-DDD | 1.2E-02 | 2.0E-03 | 7.0E-03 | 3.6E-05 | 3.1E-05 | 1.6E-03 | 1.7E-03 | 2.3E-01 | 7.6E-03 | 2.3E+00 | 7.6E-04 |
| 4,4'-DDE | 1.1E-02 | 4.6E-03 | 1.7E-02 | 3.5E-05 | 7.1E-05 | 4.1E-03 | 4.2E-03 | 2.3E-01 | 1.8E-02 | 2.3E+00 | 1.8E-03 |
| 4,4'-DDT | 1.7E-01 | 3.3E-03 | 4.8E-03 | 5.3E-04 | 5.1E-05 | 1.1E-03 | 1.7E-03 | 2.3E-01 | 7.4E-03 | 2.3E+00 | 7.4E-04 |
| Aldrin | 7.6E-04 | 1.4E-04 | 1.4E-03 | 2.4E-06 | 2.2E-06 | 3.2E-04 | 3.2E-04 | NV | NC | NV | NC |
| alpha-BHC | 2.4E-04 | 1.3E-04 | 8.1E-04 | 7.5E-07 | 2.0E-06 | 1.9E-04 | 1.9E-04 | 5.6E-01 | 3.4E-04 | 2.3E+00 | 8.6E-05 |
| beta-BHC | 9.8E-03 | 4.1E-04 | 7.8E-04 | 3.1E-05 | 6.4E-06 | 1.8E-04 | 2.2E-04 | 5.6E-01 | 3.9E-04 | 2.3E+00 | 9.8E-05 |
| Chlordane | 6.8E-02 | 3.2E-02 | 1.3E-01 | 2.1E-04 | 4.9E-04 | 3.1E-02 | 3.2E-02 | 2.1E+00 | 1.5E-02 | 1.1E+01 | 3.0E-03 |
| delta-BHC | 8.4E-03 | 7.4E-04 | 1.4E-03 | 2.6E-05 | 1.2E-05 | 3.3E-04 | 3.7E-04 | 5.6E-01 | 6.5E-04 | 2.3E+00 | 1.6E-04 |
| Dieldrin | 4.9E-03 | 1.5E-03 | 6.6E-03 | 1.5E-05 | 2.3E-05 | 1.6E-03 | 1.6E-03 | 7.1E-02 | 2.2E-02 | 3.8E+00 | 4.2E-04 |
| Endosulfan II | 6.4E-03 | 6.2E-04 | 1.7E-03 | 2.0E-05 | 9.6E-06 | 4.0E-04 | 4.3E-04 | 1.0E+01 | 4.3E-05 | NV | NC |
| Endrin | 7.4E-03 | 1.2E-03 | 4.9E-03 | 2.3E-05 | 1.9E-05 | 1.2E-03 | 1.2E-03 | 3.0E-01 | 4.0E-03 | 1.2E+00 | 9.9E-04 |
| gamma-BHC (Lindane) | 6.8E-03 | 9.0E-04 | 2.1E-03 | 2.1E-05 | 1.4E-05 | 4.9E-04 | 5.2E-04 | 2.0E+00 | 2.6E-04 | 2.0E+01 | 2.6E-05 |
| Heptachlor | 2.6E-03 | 1.7E-04 | 7.6E-04 | 8.0E-06 | 2.6E-06 | 1.8E-04 | 1.9E-04 | 2.1E+00 | 8.8E-05 | 1.1E+01 | 1.8E-05 |
| Heptachlor Epoxide | 2.2E-03 | 2.3E-03 | 4.0E-03 | 7.0E-06 | 3.5E-05 | 9.3E-04 | 9.7E-04 | 2.1E+00 | NC | 1.1E+01 | NC |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | | | | | | | | | | | |
| PCB, Total Aroclors | 4.8E-01 | 9.0E-02 | 2.6E-01 | 1.5E-03 | 1.4E-03 | 6.0E-02 | 6.3E-02 | 1.8E+00 | 3.5E-02 | 7.2E+00 | 8.7E-03 |
| PCB, Total Congeners | 2.5E+00 | 9.0E-02 | 3.5E-01 | 7.9E-03 | 1.4E-03 | 8.2E-02 | 9.2E-02 | 2.5E-01 | 3.7E-01 | 2.5E+00 | 3.7E-02 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | | | |
| Total High-molecular-weight PAHs | 8.6E+00 | 2.7E-01 | 1.2E-01 | 2.7E-02 | 4.2E-03 | 2.8E-02 | 5.9E-02 | 4.0E+01 | 1.5E-03 | 1.6E+02 | 3.7E-04 |
| Total Low-molecular-weight PAHs | 1.3E+00 | 2.3E-02 | 1.7E-02 | 3.9E-03 | 3.6E-04 | 4.0E-03 | 8.3E-03 | 4.0E+01 | 2.1E-04 | 1.6E+02 | 5.2E-05 |
| **DIOXIN/FURANs** | | | | | | | | | | | |
| TCDD TEQ Bird | 1.5E-04 | 1.5E-06 | 1.5E-06 | 4.7E-07 | 2.3E-08 | 3.6E-07 | 8.6E-07 | 1.4E-05 | 6.1E-02 | 1.4E-04 | 6.1E-03 |

**Attachment J Table 5**
**Potential Risks to the Belted Kingfisher**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| ASSUMPTIONS FOR THE BELTED KINGFISHER | |
|---|---|
| Body Weight (kg) | 0.147 |
| Exposure Duration | 1 |
| Area Use Factor | 1 |
| Sediment Consumption Rate ($kg_{dw}$/day) | 0.0005 |
| Fish Consumption Rate ($kg_{ww}$/day) | 0.093 |
| Invt. Consumption Rate ($kg_{ww}$/day) | -- |

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s]) \times ED \times AUF}{\text{Body Weight}}$$

Where:
$IR_f$ = Ingestion rate of food (kg/day)
$IR_s$ = Incidental ingestion rate of sediment (kg/day)
$C_f$ = Concentration of COPC in food (mg/kg)
$C_s$= Concentration of COPC in sediment or soil (mg/kg)
ED = Exposure duration (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the exposure area to the receptor's home range)

Notes:
BW - Body Weight.
COPC - Constituent of Potential Concern.
dw - Dry Weight.
EPC - Exposure Point Concentration.
HQ - Hazard Quotient (Dose/TRV).
LOAEL - Lowest Observed Adverse Effects Level.
NC - Not Calculated.
NOAEL - No Observed Adverse Effects Level.
NV - No Value.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
TCDD TEQ - Tetrachlorodibenzodioxin Toxic Equivalent.
TRV - Toxicity Reference Value.
ww - Wet Weight.

HQs above 1 are bolded and highlighted.

## SUPPORTING CALCULATIONS

| MAXIMUM EPC | Media Concentrations | | Potential Daily Dose (mg/$kg_{bw}$/day) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| COPC | Sediment ($mg/kg_{dw}$) | Fish ($mg/kg_{ww}$) | Sediment | Fish | Total | NOAEL-based TRV ($mg/kg_{bw}$/day) | NOAEL-based HQ | LOAEL-based TRV ($mg/kg_{bw}$/day) | LOAEL-based HQ |
| **INORGANICS** | | | | | | | | | |
| Arsenic | 5.0E+00 | 1.4E-01 | 1.6E-02 | 8.7E-02 | 1.0E-01 | 2.2E+00 | 4.6E-02 | 1.7E+01 | 6.0E-03 |
| Cadmium | 1.7E+00 | 1.2E-02 | 5.3E-03 | 7.8E-03 | 1.3E-02 | 1.5E+00 | 8.9E-03 | 6.4E+00 | 2.1E-03 |
| Chromium | 4.2E+01 | 1.3E+00 | 1.3E-01 | 8.2E-01 | 9.5E-01 | 2.7E+00 | 3.6E-01 | 5.0E+00 | 1.9E-01 |
| Copper | 7.4E+01 | 1.1E+00 | 2.4E-01 | 6.9E-01 | 9.2E-01 | 4.1E+00 | 2.3E-01 | 1.2E+01 | 7.6E-02 |
| Lead | 9.9E+01 | 7.0E-01 | 3.1E-01 | 4.4E-01 | 7.5E-01 | 1.6E+00 | 4.6E-01 | 3.3E+00 | 2.3E-01 |
| Mercury | 2.2E-01 | 3.7E-02 | 6.9E-04 | 2.4E-02 | 2.4E-02 | 2.4E-02 | 1.0E+00 | 7.8E-02 | 3.1E-01 |
| Nickel | 5.2E+01 | 6.3E-01 | 1.6E-01 | 4.0E-01 | 5.6E-01 | 6.7E+00 | 8.3E-02 | 1.9E+01 | 3.0E-02 |
| Selenium | 1.0E+00 | 3.5E-01 | 3.3E-03 | 2.2E-01 | 2.3E-01 | 2.9E-01 | 7.8E-01 | 5.8E-01 | 3.9E-01 |
| Silver | 7.9E-01 | 4.5E-03 | 2.5E-03 | 2.8E-03 | 5.3E-03 | 2.0E+00 | 2.6E-03 | 2.0E+01 | 2.6E-04 |
| Zinc | 2.4E+02 | 3.4E+01 | 7.7E-01 | 2.1E+01 | 2.2E+01 | 6.6E+01 | 3.3E-01 | 1.9E+02 | 1.2E-01 |
| **PESTICIDES** | | | | | | | | | |
| 4,4'-DDD | 1.2E-02 | 7.0E-03 | 3.7E-05 | 4.5E-03 | 4.5E-03 | 2.3E-01 | 2.0E-02 | 2.3E+00 | 2.0E-03 |
| 4,4'-DDE | 1.1E-02 | 1.7E-02 | 3.6E-05 | 1.1E-02 | 1.1E-02 | 2.3E-01 | 4.8E-02 | 2.3E+00 | 4.8E-03 |
| 4,4'-DDT | 1.7E-01 | 4.8E-03 | 5.3E-04 | 3.0E-03 | 3.5E-03 | 2.3E-01 | 1.6E-02 | 2.3E+00 | 1.6E-03 |
| Aldrin | 7.6E-04 | 1.4E-03 | 2.4E-06 | 8.6E-04 | 8.6E-04 | NV | NC | NV | NC |
| alpha-BHC | 2.4E-04 | 8.1E-04 | 7.6E-07 | 5.1E-04 | 5.1E-04 | 5.6E-01 | 9.1E-04 | 2.3E+00 | 2.3E-04 |
| beta-BHC | 9.8E-03 | 7.8E-04 | 3.1E-05 | 4.9E-04 | 5.3E-04 | 5.6E-01 | 9.3E-04 | 2.3E+00 | 2.3E-04 |
| Chlordane | 6.8E-02 | 1.3E-01 | 2.1E-04 | 8.4E-02 | 8.4E-02 | 2.1E+00 | 3.9E-02 | 1.1E+01 | 7.9E-03 |
| delta-BHC | 8.4E-03 | 1.4E-03 | 2.6E-05 | 8.9E-04 | 9.2E-04 | 5.6E-01 | 1.6E-03 | 2.3E+00 | 4.1E-04 |
| Dieldrin | 4.9E-03 | 6.6E-03 | 1.5E-05 | 4.2E-03 | 4.2E-03 | 7.1E-02 | 5.9E-02 | 3.8E+00 | 1.1E-03 |
| Endosulfan II | 6.4E-03 | 1.7E-03 | 2.0E-05 | 1.1E-03 | 1.1E-03 | 1.0E+01 | 1.1E-04 | NV | NC |
| Endrin | 7.4E-03 | 4.9E-03 | 2.3E-05 | 3.1E-03 | 3.1E-03 | 3.0E-01 | 1.0E-02 | 1.2E+00 | 2.6E-03 |
| gamma-BHC (Lindane) | 6.8E-03 | 2.1E-03 | 2.2E-05 | 1.3E-03 | 1.3E-03 | 2.0E+00 | 6.7E-04 | 2.0E+01 | 6.7E-05 |
| Heptachlor | 2.6E-03 | 7.6E-04 | 8.1E-06 | 4.8E-04 | 4.9E-04 | 2.1E+00 | 2.3E-04 | 1.1E+01 | 4.6E-05 |
| Heptachlor Epoxide | 2.2E-03 | 4.0E-03 | 7.1E-06 | 2.5E-03 | 2.5E-03 | 2.1E+00 | NC | 1.1E+01 | NC |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | | | | | | | | | |
| PCB, Total Aroclors | 4.8E-01 | 2.6E-01 | 1.5E-03 | 1.6E-01 | 1.6E-01 | 1.8E+00 | 9.1E-02 | 7.2E+00 | 2.3E-02 |
| PCB, Total Congeners | 2.5E+00 | 3.5E-01 | 8.0E-03 | 2.2E-01 | 2.3E-01 | 2.5E-01 | 9.2E-01 | 2.5E+00 | 9.2E-02 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | |
| Total High-molecular-weight PAHs | 8.6E+00 | 1.2E-01 | 2.7E-02 | 7.6E-02 | 1.0E-01 | 4.0E+01 | 2.6E-03 | 1.6E+02 | 6.4E-04 |
| Total Low-molecular-weight PAHs | 1.3E+00 | 1.7E-02 | 4.0E-03 | 1.1E-02 | 1.5E-02 | 4.0E+01 | 3.7E-04 | 1.6E+02 | 9.3E-05 |
| **DIOXIN/FURANs** | | | | | | | | | |
| TCDD TEQ Bird | 1.5E-04 | 1.5E-06 | 4.8E-07 | 9.7E-07 | 1.4E-06 | 1.4E-05 | 1.0E-01 | 1.4E-04 | 1.0E-02 |

**Attachment J Table 6**
**Potential Risks to the Raccoon**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| ASSUMPTIONS FOR THE RACCOON | |
|---|---|
| Body Weight (kg) | 5.7 |
| Exposure Duration | 1 |
| Area Use Factor | 1 |
| Sediment Consumption Rate ($kg_{dw}$/day) | 0.0143 |
| Fish Consumption Rate ($kg_{ww}$/day) | 0.5534 |
| Invt. Consumption Rate ($kg_{ww}$/day) | 0.0570 |

$$\text{Total Daily Dose} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s]) \times ED \times AUF}{\text{Body Weight}}$$

Where:
$IR_f$ = Ingestion rate of food (kg/day)
$IR_s$ = Incidental ingestion rate of sediment (kg/day)
$C_f$ = Concentration of COPC in food (mg/kg)
$C_s$= Concentration of COPC in sediment or soil (mg/kg)
ED = Exposure duration (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the exposure area to the receptor's home range)

Notes:
BW - Body Weight.
COPC - Constituent of Potential Concern.
dw - Dry Weight.
EPC - Exposure Point Concentration.
HQ - Hazard Quotient (Dose/TRV).
LOAEL - Lowest Observed Adverse Effects Level.
NOAEL - No Observed Adverse Effects Level.
NV - No Value.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
TCDD TEQ - Tetrachlorodibenzodioxin Toxic Equivalent.
TRV - Toxicity Reference Value.
ww - Wet Weight.

HQs above 1 are bolded and highlighted.

## SUPPORTING CALCULATIONS

| MAXIMUM EPC | Media Concentrations | | | Potential Daily Dose ($mg/kg_{bw}$/day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sediment | Benthic Invertebrate | Fish | Sediment | Benthic Invertebrate | Fish | | NOAEL-based TRV | | LOAEL-based TRV | |
| COPC | ($mg/kg_{dw}$) | ($mg/kg_{ww}$) | ($mg/kg_{ww}$) | | | | Total | ($mg/kg_{bw}$/day) | NOAEL-based HQ | ($mg/kg_{bw}$/day) | LOAEL-based HQ |
| **INORGANICS** | | | | | | | | | | | |
| Arsenic | 5.0E+00 | 8.3E-01 | 1.4E-01 | 1.3E-02 | 8.3E-03 | 1.3E-02 | 3.4E-02 | 1.0E+00 | 3.3E-02 | 1.7E+00 | 2.1E-02 |
| Cadmium | 1.7E+00 | 9.4E-02 | 1.2E-02 | 4.2E-03 | 9.4E-04 | 1.2E-03 | 6.4E-03 | 7.7E-01 | 8.3E-03 | 7.7E+00 | 8.3E-04 |
| Chromium | 4.2E+01 | 2.9E+00 | 1.3E+00 | 1.1E-01 | 2.9E-02 | 1.3E-01 | 2.6E-01 | 9.2E+00 | 2.8E-02 | NV | NC |
| Copper | 7.4E+01 | 6.3E+01 | 1.1E+00 | 1.9E-01 | 6.3E-01 | 1.1E-01 | 9.2E-01 | 5.6E+00 | 1.6E-01 | 9.3E+00 | 9.9E-02 |
| Lead | 9.9E+01 | 3.1E+00 | 7.0E-01 | 2.5E-01 | 3.1E-02 | 6.8E-02 | 3.5E-01 | 4.7E+00 | 7.4E-02 | 8.9E+00 | 3.9E-02 |
| Mercury | 2.2E-01 | 4.7E-02 | 3.7E-02 | 5.5E-04 | 4.7E-04 | 3.6E-03 | 4.6E-03 | 9.0E-02 | 5.2E-02 | 4.2E-01 | 1.1E-02 |
| Nickel | 5.2E+01 | 1.8E+00 | 6.3E-01 | 1.3E-01 | 1.8E-02 | 6.1E-02 | 2.1E-01 | 1.7E+00 | 1.2E-01 | 3.4E+00 | 6.2E-02 |
| Selenium | 1.0E+00 | 5.1E-01 | 3.5E-01 | 2.6E-03 | 5.1E-03 | 3.4E-02 | 4.2E-02 | 1.4E-01 | 2.9E-01 | 2.2E-01 | 2.0E-01 |
| Silver | 7.9E-01 | 5.7E-01 | 4.5E-03 | 2.0E-03 | 5.7E-03 | 4.4E-04 | 8.1E-03 | 6.0E+00 | 1.3E-03 | 6.0E+01 | 1.3E-04 |
| Zinc | 2.4E+02 | 7.6E+01 | 3.4E+01 | 6.1E-01 | 7.6E-01 | 3.3E+00 | 4.7E+00 | 7.5E+01 | 6.2E-02 | 3.0E+02 | 1.6E-02 |
| **PESTICIDES** | | | | | | | | | | | |
| 4,4'-DDD | 1.2E-02 | 2.0E-03 | 7.0E-03 | 2.9E-05 | 2.0E-05 | 6.8E-04 | 7.3E-04 | 1.5E-01 | 5.0E-03 | 7.4E-01 | 1.0E-03 |
| 4,4'-DDE | 1.1E-02 | 4.6E-03 | 1.7E-02 | 2.9E-05 | 4.6E-05 | 1.7E-03 | 1.8E-03 | 1.5E-01 | 1.2E-02 | 7.4E-01 | 2.4E-03 |
| 4,4'-DDT | 1.7E-01 | 3.3E-03 | 4.8E-03 | 4.2E-04 | 3.3E-05 | 4.6E-04 | 9.2E-04 | 1.5E-01 | 6.2E-03 | 7.4E-01 | 1.2E-03 |
| Aldrin | 7.6E-04 | 1.4E-04 | 1.4E-03 | 1.9E-06 | 1.4E-06 | 1.3E-04 | 1.4E-04 | 2.0E-01 | 6.8E-04 | 8.0E-01 | 1.7E-04 |
| alpha-BHC | 2.4E-04 | 1.3E-04 | 8.1E-04 | 6.0E-07 | 1.3E-06 | 7.9E-05 | 8.1E-05 | 1.6E+00 | 5.0E-05 | 3.2E+00 | 2.5E-05 |
| beta-BHC | 9.8E-03 | 4.1E-04 | 7.8E-04 | 2.5E-05 | 4.1E-06 | 7.6E-05 | 1.0E-04 | 4.0E-01 | 2.6E-04 | 2.0E+00 | 5.2E-05 |
| Chlordane | 6.8E-02 | 3.2E-02 | 1.3E-01 | 1.7E-04 | 3.2E-04 | 1.3E-02 | 1.3E-02 | 4.6E+00 | 2.9E-03 | 9.2E+00 | 1.5E-03 |
| delta-BHC | 8.4E-03 | 7.4E-04 | 1.4E-03 | 2.1E-05 | 7.4E-06 | 1.4E-04 | 1.7E-04 | 1.6E+00 | 1.0E-04 | 3.2E+00 | 5.2E-05 |
| Dieldrin | 4.9E-03 | 1.5E-03 | 6.6E-03 | 1.2E-05 | 1.5E-05 | 6.4E-04 | 6.7E-04 | 1.5E-02 | 4.5E-02 | 3.0E-02 | 2.2E-02 |
| Endosulfan II | 6.4E-03 | 6.2E-04 | 1.7E-03 | 1.6E-05 | 6.2E-06 | 1.7E-04 | 1.9E-04 | 1.5E-01 | 1.3E-03 | NV | NC |
| Endrin | 7.4E-03 | 1.2E-03 | 4.9E-03 | 1.9E-05 | 1.2E-05 | 4.8E-04 | 5.1E-04 | 9.2E-02 | 5.5E-03 | 9.2E-01 | 5.5E-04 |
| gamma-BHC (Lindane) | 6.8E-03 | 9.0E-04 | 2.1E-03 | 1.7E-05 | 9.0E-06 | 2.0E-04 | 2.3E-04 | 5.0E-02 | 4.6E-03 | 3.8E+00 | 6.1E-05 |
| Heptachlor | 2.6E-03 | 1.7E-04 | 7.6E-04 | 6.4E-06 | 1.7E-06 | 7.4E-05 | 8.2E-05 | 1.3E-01 | 6.3E-04 | 6.8E+00 | 1.2E-05 |
| Heptachlor Epoxide | 2.2E-03 | 2.3E-03 | 4.0E-03 | 5.6E-06 | 2.3E-05 | 3.9E-04 | 4.2E-04 | 1.0E-01 | 4.2E-03 | 1.0E+00 | 4.2E-04 |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | | | | | | | | | | | |
| PCB, Total Aroclors | 4.8E-01 | 9.0E-02 | 2.6E-01 | 1.2E-03 | 9.0E-04 | 2.5E-02 | 2.7E-02 | 1.4E-01 | 1.9E-01 | 6.9E-01 | 3.9E-02 |
| PCB, Total Congeners | 2.5E+00 | 9.0E-02 | 3.5E-01 | 6.4E-03 | 9.0E-04 | 3.4E-02 | 4.1E-02 | 1.8E+00 | 2.3E-02 | 7.2E+00 | 5.8E-03 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | | | |
| Total High-molecular-weight PAHs | 8.6E+00 | 2.7E-01 | 1.2E-01 | 2.1E-02 | 2.7E-03 | 1.2E-02 | 3.6E-02 | 6.2E-01 | 5.8E-02 | 3.3E+01 | 1.1E-03 |
| Total Low-molecular-weight PAHs | 1.3E+00 | 2.3E-02 | 1.7E-02 | 3.2E-03 | 2.3E-04 | 1.7E-03 | 5.1E-03 | 6.6E+01 | 7.8E-05 | 3.3E+02 | 1.6E-05 |
| **DIOXIN/FURANs** | | | | | | | | | | | |
| TCDD TEQ Mammal | NV | 8.4E-07 | 9.5E-07 | NC | 8.4E-09 | 9.2E-08 | 1.0E-07 | 1.0E-06 | 1.0E-01 | 1.0E-05 | 1.0E-02 |

**Attachment J Table 7**
**Summary of Potential Risks to Wildlife**
**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**

| | Hazard Quotients | | | | | |
|---|---|---|---|---|---|---|
| | Maximum EPC | | | | | |
| | Great Blue Heron | | Belted Kingfisher | | Raccoon | |
| **COPC** | **NOAEL-based HQ** | **LOAEL-based HQ** | **NOAEL-based HQ** | **LOAEL-based HQ** | **NOAEL-based HQ** | **LOAEL-based HQ** |
| **INORGANICS** | | | | | | |
| Arsenic | 2.7E-02 | 3.5E-03 | 4.6E-02 | 6.0E-03 | 3.3E-02 | 2.1E-02 |
| Cadmium | 6.5E-03 | 1.5E-03 | 8.9E-03 | 2.1E-03 | 8.3E-03 | 8.3E-04 |
| Chromium | 1.8E-01 | 9.6E-02 | 3.6E-01 | 1.9E-01 | 2.8E-02 | NC |
| Copper | 3.6E-01 | 1.2E-01 | 2.3E-01 | 7.6E-02 | 1.6E-01 | 9.9E-02 |
| Lead | 3.2E-01 | 1.6E-01 | 4.6E-01 | 2.3E-01 | 7.4E-02 | 3.9E-02 |
| Mercury | 4.2E-01 | 1.3E-01 | 1.0E+00 | 3.1E-01 | 5.2E-02 | 1.1E-02 |
| Nickel | 5.0E-02 | 1.8E-02 | 8.3E-02 | 3.0E-02 | 1.2E-01 | 6.2E-02 |
| Selenium | 3.2E-01 | 1.6E-01 | 7.8E-01 | 3.9E-01 | 2.9E-01 | 2.0E-01 |
| Silver | 6.1E-03 | 6.1E-04 | 2.6E-03 | 2.6E-04 | 1.3E-03 | 1.3E-04 |
| Zinc | 1.5E-01 | 5.3E-02 | 3.3E-01 | 1.2E-01 | 6.2E-02 | 1.6E-02 |
| **PESTICIDES** | | | | | | |
| 4,4'-DDD | 7.6E-03 | 7.6E-04 | 2.0E-02 | 2.0E-03 | 5.0E-03 | 1.0E-03 |
| 4,4'-DDE | 1.8E-02 | 1.8E-03 | 4.8E-02 | 4.8E-03 | 1.2E-02 | 2.4E-03 |
| 4,4'-DDT | 7.4E-03 | 7.4E-04 | 1.6E-02 | 1.6E-03 | 6.2E-03 | 1.2E-03 |
| Aldrin | NC | NC | NC | NC | 6.8E-04 | 1.7E-04 |
| alpha-BHC | 3.4E-04 | 8.6E-05 | 9.1E-04 | 2.3E-04 | 5.0E-05 | 2.5E-05 |
| beta-BHC | 3.9E-04 | 9.8E-05 | 9.3E-04 | 2.3E-04 | 2.6E-04 | 5.2E-05 |
| Chlordane | 1.5E-02 | 3.0E-03 | 3.9E-02 | 7.9E-03 | 2.9E-03 | 1.5E-03 |
| delta-BHC | 6.5E-04 | 1.6E-04 | 1.6E-03 | 4.1E-04 | 1.0E-04 | 5.2E-05 |
| Dieldrin | 2.2E-02 | 4.2E-04 | 5.9E-02 | 1.1E-03 | 4.5E-02 | 2.2E-02 |
| Endosulfan II | 4.3E-05 | NC | 1.1E-04 | NC | 1.3E-03 | NC |
| Endrin | 4.0E-03 | 9.9E-04 | 1.0E-02 | 2.6E-03 | 5.5E-03 | 5.5E-04 |
| gamma-BHC (Lindane) | 2.6E-04 | 2.6E-05 | 6.7E-04 | 6.7E-05 | 4.6E-03 | 6.1E-05 |
| Heptachlor | 8.8E-05 | 1.8E-05 | 2.3E-04 | 4.6E-05 | 6.3E-04 | 1.2E-05 |
| Heptachlor Epoxide | NC | NC | NC | NC | 4.2E-03 | 4.2E-04 |
| **POLYCHLORINATED BIPHENYLS (PCBs)** | | | | | | |
| PCB, Total Aroclors | 3.5E-02 | 8.7E-03 | 9.1E-02 | 2.3E-02 | 1.9E-01 | 3.9E-02 |
| PCB, Total Congeners | 3.7E-01 | 3.7E-02 | 9.2E-01 | 9.2E-02 | 2.3E-02 | 5.8E-03 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | |
| Total High-molecular-weight PAHs | 1.5E-03 | 3.7E-04 | 2.6E-03 | 6.4E-04 | 5.8E-02 | 1.1E-03 |
| Total Low-molecular-weight PAHs | 2.1E-04 | 5.2E-05 | 3.7E-04 | 9.3E-05 | 7.8E-05 | 1.6E-05 |
| **DIOXIN/FURANs** | | | | | | |
| TCDD TEQ Bird | 6.1E-02 | 6.1E-03 | 1.0E-01 | 1.0E-02 | -- | -- |
| TCDD TEQ Mammal | -- | -- | -- | -- | 1.0E-01 | 1.0E-02 |

Notes:
HQs above 1 are bolded and highlighted.

COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
HQ - Hazard Quotient.
LOAEL - Lowest Observed Adverse Effects Level.
NC - Not Calculated. Avian TRV not available.

NOAEL - No Observed Adverse Effect Level.
PAHs - Polycyclic Aromatic Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
TCDD TEQ - Tetrachlorodibenzodioxin Toxic Equivalent.
TRV - Toxicity Reference Value.

**Attachment J Table 8**
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**Benning Road Facility RI Report**
**3400 Benning Rd, N.E., Washington DC 20019**


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# Attachment K

# Statistical Comparisons of Sediment Chemistry

# 1 Introduction

Pepco conducted field investigations in the Waterside Investigation Area in 2013 and 2017 as part of the Phase I and Phase II RI and the analytical data from both phases are included in the BERA. Pepco collected Phase I RI sediment samples at 46 locations in the Waterside Investigation Area. In Phase II, Pepco collected surface sediment samples at 15 locations in the vicinity of the Cove, which was the area of focus for the Phase II sample collection because the greatest range and highest concentrations of COPCs were detected at Cove locations during Phase I. For some COPCs, higher concentrations were observed at these stations in 2013; however, for other COPCs, higher concentrations were detected in the 2017 sampling round. The BERA lines of evidence for the benthic invertebrate community evaluation, which include the sediment bioassays, benthic invertebrate community survey, pore water evaluations, and bioavailability of divalent metals and PAHs, are focused on Phase II samples collected in the Cove, and the results of these lines of evidence are used to draw conclusions for the entire Study Area. Therefore, to determine if the Phase II sediment chemistry is similar to, and thus representative of, the chemistry in the remainder of Waterside Investigation Area (i.e., Pepco Phase I sediment samples and ARSP sediment samples collected by Tetra Tech on behalf of DOEE in the Waterside Investigation Area), statistical and graphical comparisons were conducted on surface sediment analytical data collected in Phase II versus the remainder of the Waterside Investigation Area.

In addition, the results of the benthic lines of evidence such as the sediment bioassays and benthic community survey are discussed in terms of samples located in the Cove proper (i.e., close to Outfall 013) where the habitat consists of stagnant shallow water and mudflats versus samples located in the river channel where the habitat consists of faster moving, deeper water. As such, statistical and graphical comparisons were conducted on the sediment chemistry data of Phase II samples collected in the Cove versus Phase II samples collected in the river channel to determine if there are differences in sediment chemistry among these two areas.

The following sections describe the methodology and results of the statistical comparisons conducted.

# 2 Comparisons of Phase II and Remainder of Waterside Investigation Area

The comparison of analytical results for sediment samples collected in Phase II to samples collected in the remainder of the Waterside Investigation Area is based on two populations:

- Phase II samples: surface sediment samples collected by Pepco at 15 locations in the vicinity of the Cove in June 2017.
- Waterside Investigation Area (WIA) Samples: surface sediment samples collected by Pepco in 2013 and by Tetra Tech on behalf of DOEE in 2014, 2015, and 2016 at up to 49 locations in the Study Area outside of the Cove (i.e., do not overlap with Phase II samples).

The surface sediment samples and associated analytical chemistry data are presented in **Table 1**.

To determine if the Phase II and WIA populations are similar, a two-sample hypothesis test was conducted. Populations are 'statistically similar' if their means are not statistically different (based on a parametric test) or if the distance between ordered observations is not too large (based on a nonparametric test). This analysis included three COPCs identified in the BERA as potential drivers of risk for benthic invertebrates (Section 7 of the BERA) for which sufficient data are available in both populations including total PCBs (both Aroclors and congeners), total PAHs, and DDE. Percent fines and total organic carbon (TOC) are also included.

First, the distribution of COPC concentrations or physical parameters of both the Phase II and WIA datasets was determined. Next, a two-sample test was selected depending upon the distribution and the presence/absence of non-detect values of each dataset. When both the Phase II and the WIA datasets were normally distributed with no non-detect values, a parametric test (t-test) was conducted. When the Phase II and/or the WIA datasets were not normal (gamma or lognormal) or did not follow a discernible distribution, a non-parametric test was selected as follows: the Wilcoxon test was selected when no non-detect values were present in either dataset and the Tarone-Ware test was selected when one or both datasets had non-detect values. Boxplot comparisons were also created for each comparison. The statistical comparisons and the boxplots were conducted using R software.[1]

**Table 2** presents the results of the statistical comparisons. The two-sample comparison tests assume that the Phase II concentrations arise from the same distribution as the WIA concentrations and the two populations are similar. The null and alternative hypotheses are defined as:

> $H_o$ (null): the means or central tendencies of both sample sets are not statistically different ($p > 0.05$: fail to reject $H_o$)
> $H_a$ (alternative): the means or central tendencies of both sample sets are statistically different ($p < 0.05$: reject $H_o$)

[1] Comparison test output is presented at the end of this attachment.

Based on these comparisons, concentrations of total PCB Aroclors, total PAHs, and DDE, and percent fines are not statistically different between the Phase II and WIA samples. Total PCB congeners and TOC are statistically different ($p<0.05$). TOC is generally higher in the Cove in comparison to the rest of the Study Area. Total PCB congeners are also higher in the Cove, but the differences in sample size (6 samples in the Phase II dataset versus 21 samples in the WIA dataset) are a factor in this difference.

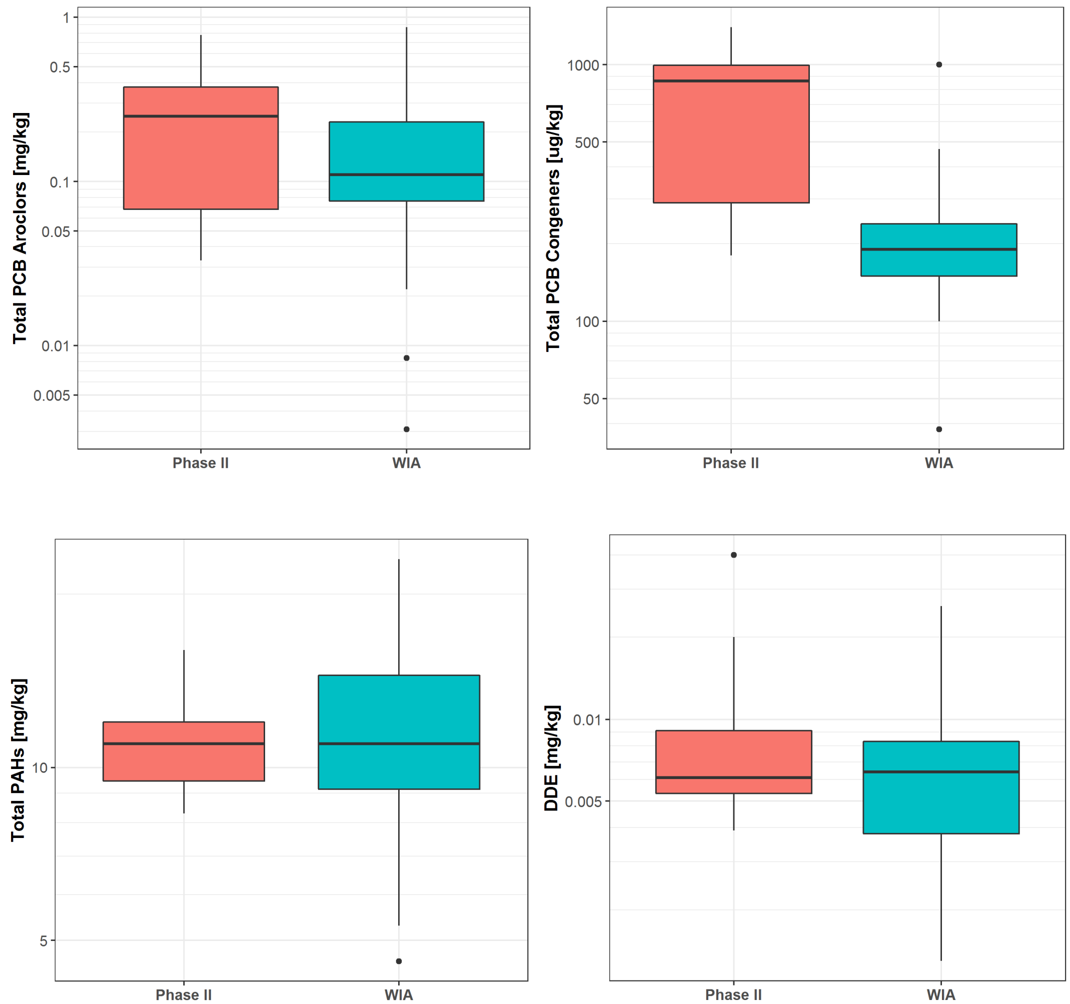
These results indicate that the 15 Phase II samples are representative of sediment chemistry throughout the WIA for the COPCs identified as potential risk drivers in the BERA. These results support the sediment quality triad, specifically the sediment benchmark screening of the Phase II sediment samples as part of the evaluation of six measurement endpoints for the benthic community risk assessment (i.e., sediment COPC distribution and bioavailability in sediment and pore water, benthic community evaluation, and sediment toxicity), presented in the BERA Risk Characterization (Section 5.1.2.1). These results were also discussed in the BERA Uncertainty Evaluation (Section 6.1.2) to illustrate that while the temporal variability of Phase II and WIA samples introduces some uncertainty into the risk characterization process, it is not likely to change the risk assessment findings relative to the ecological receptors.

**Table 2. Comparisons of Sediment Chemistry of Phase II Samples and Samples Collected in Remainder of Waterside Investigation Area**

| COPC | Sample Size | | Number of Non detects | | Distribution | | Median (mg/kg) | | Test | p-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | WIA | Phase II | WIA | Phase II | WIA | Phase II | WIA | Phase II | | |
| Total PCB Aroclors | 49 | 15 | 1 | 0 | Gamma | Gamma | 0.11 | 0.25 | Tarone-Ware | 0.28 |
| Total PCB congeners | 21 | 6 | 0 | 0 | Lognormal | Normal | 0.19 | 0.87 | Wilcoxon | **0.02** |
| Total PAHs | 19 | 15 | 0 | 0 | Gamma | Lognormal | 11 | 11 | Wilcoxon | 0.83 |
| DDE | 25 | 15 | 1 | 0 | Lognormal | Nonparametric | 0.0064 | 0.0061 | Tarone-Ware | 0.17 |
| Percent Fines | 20 | 15 | 0 | 0 | Normal | Normal | 52.4% | 59.3% | t-test | 0.28 |
| TOC | 48 | 15 | 0 | 0 | Normal | Normal | 37500 | 65000 | t-test | **0.00** |

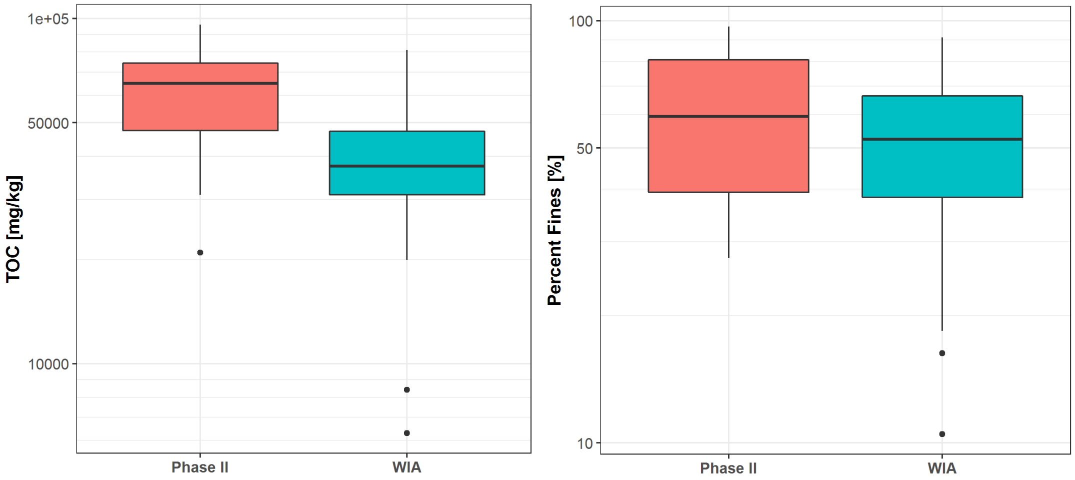
WIA – Waterside Investigation Area (includes surface sediment samples collected by Pepco in 2013 and by Tetra Tech on behalf of DOEE in 2014, 2015, and 2016)
A p-value less than 0.05 indicates a significant difference between WIA and Phase II concentrations.

Boxplot Comparisons of Phase II Samples and Samples Collected in Remainder of Waterside Investigation Area




The boxplot represents the 25th, 50th, and 75th percentiles. The lower and upper whiskers are based on the nearest data points to the 25th or 75th percentiles minus or plus the interquartile range, respectively.

Boxplot Comparisons of Phase II Samples and Samples Collected in Remainder of Waterside Investigation Area




The boxplot represents the 25th, 50th, and 75th percentiles. The lower and upper whiskers are based on the nearest data points to the 25th or 75th percentiles minus or plus the interquartile range, respectively.

# 3 Comparisons of Cove and Channel Samples

The results of the benthic risk characterization in the BERA, including the sediment bioassays and benthic community survey, are discussed in terms of samples located in the Cove proper (i.e., close to Outfall 013) where the habitat consists of stagnant shallow water and mudflats versus samples located in the river channel where the habitat consists of faster moving, deeper water. Statistical comparisons were conducted to evaluate if there is a difference in sediment chemistry between the two areas. The comparison of analytical results for Phase II sediment samples collected in the Cove to samples collected in the river channel is based on two populations:

- Cove samples: surface sediment samples collected at 7 locations in the Cove close to Outfall 013 in June 2017.
- Channel samples: surface sediment samples collected at 8 locations in the river channel in June 2017.

The surface sediment samples and associated analytical chemistry data are presented in **Table 1**.

A two-sample hypothesis test was conducted to determine if these two populations are similar. Populations are 'statistically similar' if their means are not statistically different (based on parametric tests) or if the distance between ordered observations is not too large (based on non-parametric tests). This analysis included three COPCs identified in the BERA as potential drivers of risk for benthic invertebrates (Section 7 of BERA) for which sufficient data are available in both populations including total PCBs Aroclors[2], total PAHs, and DDE. Percent fines and total organic carbon (TOC) is also included.

First, the distribution of COPC concentrations or physical parameters of both populations was determined. Next, depending upon the distribution type and presence/absence of non-detect values, a parametric test (t-test) or non-parametric test (Wilcoxon or Tarone-Ware) was conducted. Boxplot comparisons were also created for each comparison (as described in Section 2).

**Table 3** presents the results of the statistical comparisons. The two-sample comparison tests assume that the Cove concentrations arise from the same distribution as the channel concentrations and the two populations are similar. The null and alternative hypotheses are defined as:

[2] Insufficient samples are available for this comparison for total PCB congeners.

$H_o$ (null): the means or central tendencies of both sample sets are not statistically different ($p > 0.05$: fail to reject $H_o$)
$H_a$ (alternative): the means or central tendencies of both sample sets are statistically different ($p < 0.05$: reject $H_o$)

Based on these comparisons, concentrations of total PCB Aroclors, total PAHs, and DDE, percent fines, and TOC are not statistically different between Cove and Channel samples. The boxplots illustrating these comparisons support these results. These results indicate that the Phase II Cove and Channel samples are similar in sediment chemistry.

The results of these statistical comparisons support the results of the benthic community survey presented in the benthic community risk characterization of the BERA (Section 5.1.2.4). The community survey identified two general groupings of benthic organisms in the WIA: one in the Cove and one in the Channel. Although higher median concentrations of total PCB Aroclor and total PAH concentrations were detected in the Cove (as illustrated by the boxplots), sediment chemistry of Cove and Channel samples were not found to be significantly different. Other factors such as physical characteristics may be related to the two benthic community groupings identified in the Cove and Channel.

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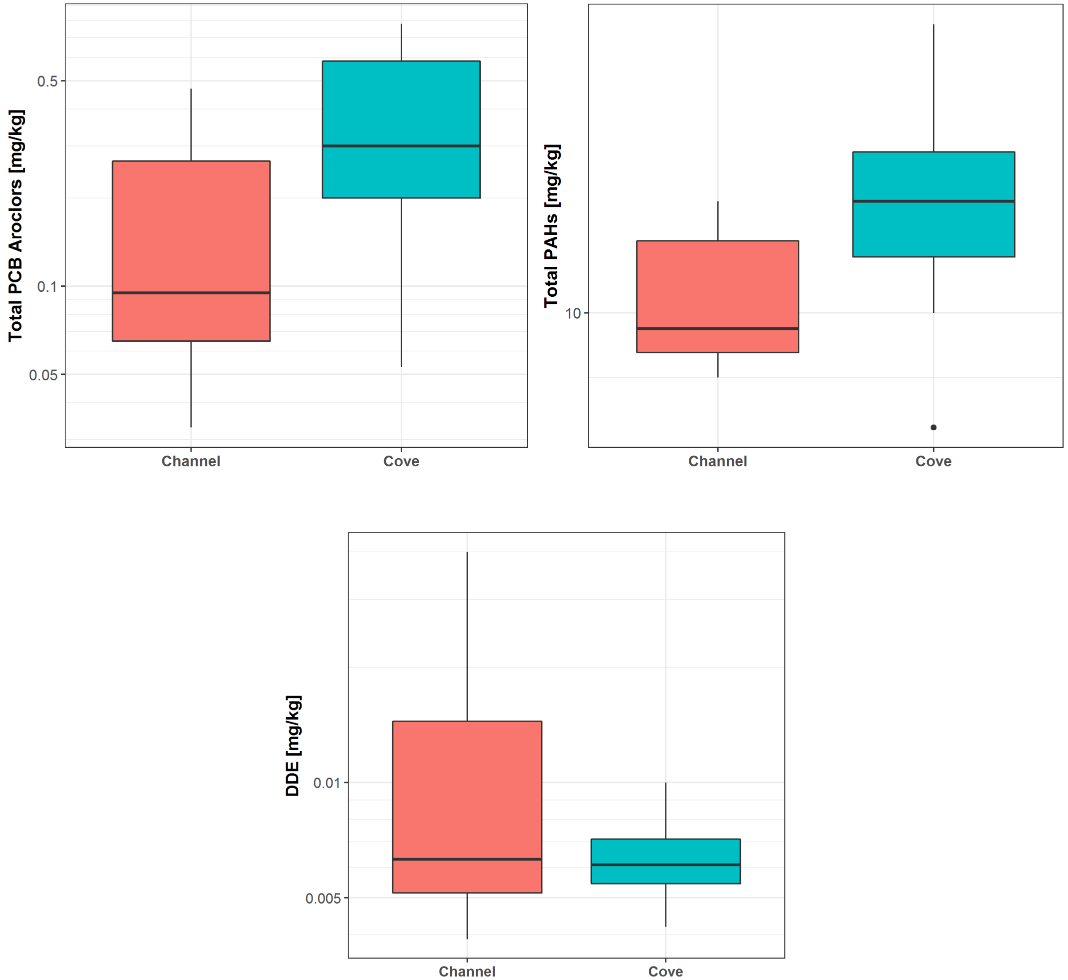
**Table 3. Comparisons of Sediment Chemistry of Cove Samples and Channel Samples Collected in the WIA**

| COPC | Sample Size | | Number of Non detects | | Distribution | | Median (mg/kg) | | Test | p-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cove | Channel | Cove | Channel | Cove | Channel | Cove | Channel | | |
| Total PCB Aroclors | 7 | 8 | 0 | 0 | Gamma | Lognormal | 0.30 | 0.10 | Wilcoxon | 0.11 |
| Total PAHs | 7 | 8 | 0 | 0 | Normal | Lognormal | 12 | 9.75 | Wilcoxon | 0.09 |
| DDE | 7 | 8 | 0 | 0 | Lognormal | Lognormal | 0.0061 | 0.0063 | Wilcoxon | 0.64 |
| Percent Fines | 7 | 8 | 0 | 0 | Lognormal | Normal | 50.1% | 78.4% | Wilcoxon | 0.16 |
| TOC | 7 | 8 | 0 | 0 | Lognormal | Normal | 58000 | 66500 | Wilcoxon | 0.91 |

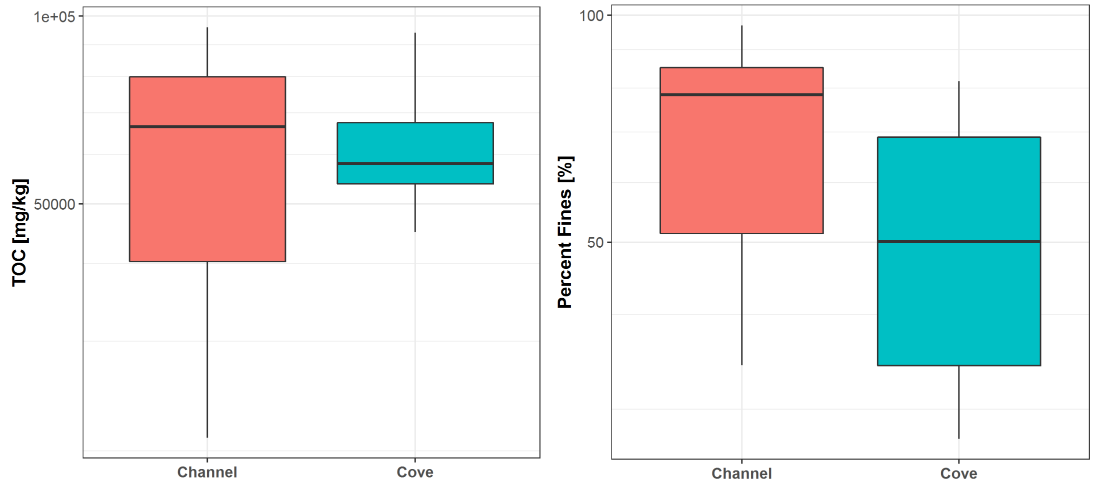
A p-value less than 0.05 indicates a significant difference between Cove and channel samples.

<u>Boxplot Comparisons of Phase II Samples and Samples Collected in Remainder of Waterside Investigation Area</u>




The boxplot represents the 25th, 50th, and 75th percentiles. The lower and upper whiskers are based on the nearest data points to the 25th or 75th percentiles minus or plus the interquartile range, respectively.

Boxplot Comparisons of Phase II Samples and Samples Collected in Remainder of Waterside Investigation Area




The boxplot represents the 25th, 50th, and 75th percentiles. The lower and upper whiskers are based on the nearest data points to the 25th or 75th percentiles minus or plus the interquartile range, respectively.

<u>Comparison Test Output: Phase II versus WIA</u>

$`Total PCB Aroclors`

Results of Hypothesis Test

Based on Censored Data

--------------------------

Null Hypothesis: Fy(t) = Fx(t)

Alternative Hypothesis: Fy(t) != Fx(t) for at least one t

Test Name: Two-Sample Linear Rank Test:

Logrank Test

with Hypergeometric Variance

Censoring Side: left

Censoring Level(s): x = 0.0084

y =

Data: x = tempDatP1

y = tempDatP2

Censoring Variable: x = tempDetP1

y = tempDetP2

Sample Sizes: nx = 49

ny = 15

Percent Censored: x = 2%

y = 0%

Test Statistics: nu = -3.277268

var.nu = 9.124294

z = -1.084957

P-value: 0.2779409

$`Total PCB Congeners`

Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation

data: tempDatP1tempDatP2

z = -2.3967, p-value = 0.01655

alternative hypothesis: true Fy(t) is Fx(t)

$`Total PAHs`

Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation

data: tempDatP1tempDatP2

z = 0.20886, p-value = 0.8346

alternative hypothesis: true Fy(t) is Fx(t)

$DDE

Results of Hypothesis Test

Based on Censored Data

--------------------------

Null Hypothesis: Fy(t) = Fx(t)

Alternative Hypothesis: Fy(t) != Fx(t) for at least one t

Test Name: Two-Sample Linear Rank Test:

Logrank Test

with Hypergeometric Variance

Censoring Side: left

Censoring Level(s): x = 0.0013

y =

Data: x = tempDatP1

y = tempDatP2

Censoring Variable: x = tempDetP1

y = tempDetP2

Sample Sizes: nx = 25

ny = 15

Percent Censored: x = 4%

y = 0%

Test Statistics: nu = -3.630619

var.nu = 7.124847

z = -1.360169

P-value: 0.1737764

$`Percent Fines`

Welch Two Sample t-test

data:  tempDatP1 and tempDatP2

t = -1.0905, df = 30.058, p-value = 0.2842

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-25.197800   7.654467

sample estimates:

mean of x mean of y

52.91500  61.68667

$TOC

Welch Two Sample t-test

data:  tempDatP1 and tempDatP2

t = -3.9395, df = 18.335, p-value = 0.0009323

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-35866.05 -10938.12

sample estimates:

mean of x mean of y

38397.92  61800.00

Comparison Test Output: Cove versus Channel

$`Total PCB Aroclors`

Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation

data: tempDatCvtempDatCh

z = 1.6202, p-value = 0.1052

alternative hypothesis: true Fy(t) is Fx(t)

$`Total PAHs`

Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation

data: tempDatCvtempDatCh

z = 1.6963, p-value = 0.08982

alternative hypothesis: true Fy(t) is Fx(t)

$DDE

Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation

data: tempDatCvtempDatCh

z = -0.46457, p-value = 0.6422

alternative hypothesis: true Fy(t) is Fx(t)

$`Percent Fines`

Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation data:  tempDatCvtempDatCh

z = -1.3887, p-value = 0.1649

alternative hypothesis: true Fy(t) is  Fx(t)

$TOC

Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation

data:  tempDatCvtempDatCh

z = -0.11583, p-value = 0.9078

alternative hypothesis: true Fy(t) is  Fx(t)

**Attachment K Table 1**
**Waterside Investigation Area Surface Sediment Samples Included in Statistical Comparisons**

| Source | Location of Phase II Samples | Location | Collected | Depth | Chemical | Units | Result | Detect |
|---|---|---|---|---|---|---|---|---|
| Phase I and ARSP | -- | SED2B | 11/5/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.11 | 1 |
| Phase I and ARSP | -- | SED2C | 11/6/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.23 | 1 |
| Phase I and ARSP | -- | SED2A | 11/6/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.23 | 1 |
| Phase I and ARSP | -- | SED1.5B | 11/6/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.23 | 1 |
| Phase I and ARSP | -- | SED1A | 11/6/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.15 | 1 |
| Phase I and ARSP | -- | SED1B | 11/6/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.078 | 1 |
| Phase I and ARSP | -- | SED2.5B | 11/7/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.076 | 1 |
| Phase I and ARSP | -- | SED1C | 11/7/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.11 | 1 |
| Phase I and ARSP | -- | SED3C | 11/7/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.19 | 1 |
| Phase I and ARSP | -- | SED3A | 11/7/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.0084 | 0 |
| Phase I and ARSP | -- | SED3B | 11/8/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.042 | 1 |
| Phase I and ARSP | -- | SED4.5B | 11/8/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.19 | 1 |
| Phase I and ARSP | -- | SED5A | 11/8/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.13 | 1 |
| Phase I and ARSP | -- | SED5B | 11/8/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.23 | 1 |
| Phase I and ARSP | -- | SED5C | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.75 | 1 |
| Phase I and ARSP | -- | SED9A | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.074 | 1 |
| Phase I and ARSP | -- | SED9C | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.17 | 1 |
| Phase I and ARSP | -- | SED9B | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.18 | 1 |
| Phase I and ARSP | -- | SED9.5B | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.38 | 1 |
| Phase I and ARSP | -- | SED10A | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.0031 | 1 |
| Phase I and ARSP | -- | SED10B | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.066 | 1 |
| Phase I and ARSP | -- | SED10C | 11/11/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.077 | 1 |
| Phase I and ARSP | -- | SED3.5B | 11/12/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.05 | 1 |
| Phase I and ARSP | -- | SED4B | 11/12/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.87 | 1 |
| Phase I and ARSP | -- | SED4A | 11/12/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.15 | 1 |
| Phase I and ARSP | -- | SED4C | 11/12/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.39 | 1 |
| Phase I and ARSP | -- | SED5.5B | 11/12/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.16 | 1 |
| Phase I and ARSP | -- | SED8.5B | 11/13/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.11 | 1 |
| Phase I and ARSP | -- | WSED1 | 11/15/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.33 | 1 |
| Phase I and ARSP | -- | WSED2 | 11/15/2013 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.17 | 1 |
| Phase I and ARSP | -- | SED7G | 1/30/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.23 | 1 |
| Phase I and ARSP | -- | R5-03 | 7/25/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.097 | 1 |
| Phase I and ARSP | -- | R6-03 | 7/28/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.46 | 1 |
| Phase I and ARSP | -- | R6-02 | 7/28/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.058 | 1 |
| Phase I and ARSP | -- | R5-04 | 7/28/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.053 | 1 |
| Phase I and ARSP | -- | R5-05 | 7/30/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.11 | 1 |
| Phase I and ARSP | -- | R6-07 | 7/30/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.028 | 1 |
| Phase I and ARSP | -- | R6-06 | 8/4/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.0845 | 1 |
| Phase I and ARSP | -- | R6-01 | 8/5/2014 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.081 | 1 |
| Phase I and ARSP | -- | R5-06 | 4/30/2015 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.091 | 1 |
| Phase I and ARSP | -- | R6-18 | 4/30/2015 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.088 | 1 |
| Phase I and ARSP | -- | R6-22 | 4/30/2015 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.089 | 1 |
| Phase I and ARSP | -- | R6-23 | 4/30/2015 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.066 | 1 |
| Phase I and ARSP | -- | R5-08 | 6/9/2016 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.35 | 1 |
| Phase I and ARSP | -- | R6-30 | 6/9/2016 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.24 | 1 |
| Phase I and ARSP | -- | R6-33 | 6/28/2016 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.022 | 1 |
| Phase I and ARSP | -- | R6-31 | 6/28/2016 | 0 - 0.5 ft | Total PCB Aroclors | mg/kg | 0.043 | 1 |
| Phase I and ARSP | -- | SED5B | 6/20/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.18 | 1 |
| Phase I and ARSP | -- | SED1.5C | 6/21/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.087 | 1 |
| Phase II | Channel | SED6C | 6/7/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.29 | 1 |
| Phase II | Channel | SED8C | 6/7/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.26 | 1 |
| Phase II | Channel | SED7B | 6/7/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.47 | 1 |
| Phase II | Cove | SED7F | 6/8/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.3 | 1 |
| Phase II | Cove | SED7.5E | 6/8/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.78 | 1 |
| Phase II | Cove | SED6.5E | 6/8/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.25 | 1 |
| Phase II | Cove | SED7E | 6/8/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.63 | 1 |
| Phase II | Channel | SED6B | 6/8/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.13 | 1 |
| Phase II | Channel | SED6A | 6/8/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.069 | 1 |
| Phase II | Cove | SED7.5D | 6/9/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.54 | 1 |
| Phase II | Cove | SED7D | 6/9/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.053 | 1 |
| Phase II | Cove | SED6.5D | 6/9/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.16 | 1 |
| Phase II | Channel | SED8A | 6/9/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.059 | 1 |
| Phase II | Channel | SED7A | 6/9/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.067 | 1 |
| Phase II | Channel | SED8B | 6/9/2017 | 0 - 0.33 ft | Total PCB Aroclors | mg/kg | 0.033 | 1 |
| Phase I and ARSP | -- | R5-03 | 7/25/2014 | 0 - 0.5 ft | Total PCB Congeners | μg/kg | 160 | 1 |
| Phase I and ARSP | -- | R5-04 | 7/28/2014 | 0 - 0.5 ft | Total PCB Congeners | μg/kg | 190 | 1 |
| Phase I and ARSP | -- | R5-05 | 7/30/2014 | 0 - 0.5 ft | Total PCB Congeners | μg/kg | 240 | 1 |
| Phase I and ARSP | -- | R5-06 | 4/30/2015 | 0 - 0.5 ft | Total PCB Congeners | μg/kg | 100 | 1 |
| Phase I and ARSP | -- | R5-08 | 6/9/2016 | 0 - 0.5 ft | Total PCB Congeners | μg/kg | 470 | 1 |
| Phase I and ARSP | -- | R5-09 | 6/28/2016 | 0 - 0.5 ft | Total PCB Congeners | μg/kg | 100 | 1 |

**Attachment K Table 1**
**Waterside Investigation Area Surface Sediment Samples Included in Statistical Comparisons**

| Source | Location of Phase II Samples | Location | Collected | Depth | Chemical | Units | Result | Detect |
|---|---|---|---|---|---|---|---|---|
| Phase I and ARSP | -- | R6-01 | 8/5/2014 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 100 | 1 |
| Phase I and ARSP | -- | R6-02 | 7/28/2014 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 280 | 1 |
| Phase I and ARSP | -- | R6-03 | 7/28/2014 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 1000 | 1 |
| Phase I and ARSP | -- | R6-06 | 8/4/2014 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 127.9 | 1 |
| Phase I and ARSP | -- | R6-07 | 7/30/2014 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 38 | 1 |
| Phase I and ARSP | -- | R6-18 | 4/30/2015 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 190 | 1 |
| Phase I and ARSP | -- | R6-22 | 4/30/2015 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 190 | 1 |
| Phase I and ARSP | -- | R6-23 | 4/30/2015 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 150 | 1 |
| Phase I and ARSP | -- | R6-30 | 6/9/2016 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 236 | 1 |
| Phase I and ARSP | -- | R6-31 | 6/28/2016 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 240 | 1 |
| Phase I and ARSP | -- | R6-33 | 6/28/2016 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 170 | 1 |
| Phase I and ARSP | -- | SED1.5C | 6/21/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 180 | 1 |
| Phase I and ARSP | -- | SED2A | 11/6/2013 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 294 | 1 |
| Phase I and ARSP | -- | SED5B | 6/20/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 240 | 1 |
| Phase I and ARSP | -- | SED9.5B | 11/11/2013 | 0 - 0.5 ft | Total PCB Congeners | µg/kg | 170 | 1 |
| Phase II | Cove | SED6.5E | 6/8/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 760 | 1 |
| Phase II | Channel | SED6A | 6/8/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 180 | 1 |
| Phase II | Channel | SED6B | 6/8/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 210 | 1 |
| Phase II | Cove | SED7.5E | 6/8/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 1400 | 1 |
| Phase II | Cove | SED7E | 6/8/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 980 | 1 |
| Phase II | Cove | SED7F | 6/8/2017 | 0 - 0.33 ft | Total PCB Congeners | µg/kg | 1000 | 1 |
| Phase I and ARSP | -- | R5-03 | 7/25/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 23 | 1 |
| Phase I and ARSP | -- | R5-04 | 7/28/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 10 | 1 |
| Phase I and ARSP | -- | R5-05 | 7/30/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 16 | 1 |
| Phase I and ARSP | -- | R5-06 | 4/30/2015 | 0 - 0.5 ft | Total PAHs | mg/kg | 17 | 1 |
| Phase I and ARSP | -- | R5-08 | 6/9/2016 | 0 - 0.5 ft | Total PAHs | mg/kg | 5.8 | 1 |
| Phase I and ARSP | -- | R6-01 | 8/5/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 11 | 1 |
| Phase I and ARSP | -- | R6-02 | 7/28/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 9.8 | 1 |
| Phase I and ARSP | -- | R6-03 | 7/28/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 5.3 | 1 |
| Phase I and ARSP | -- | R6-06 | 8/4/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 12.4 | 1 |
| Phase I and ARSP | -- | R6-07 | 7/30/2014 | 0 - 0.5 ft | Total PAHs | mg/kg | 4.6 | 1 |
| Phase I and ARSP | -- | R6-18 | 4/30/2015 | 0 - 0.5 ft | Total PAHs | mg/kg | 9 | 1 |
| Phase I and ARSP | -- | R6-22 | 4/30/2015 | 0 - 0.5 ft | Total PAHs | mg/kg | 9.3 | 1 |
| Phase I and ARSP | -- | R6-23 | 4/30/2015 | 0 - 0.5 ft | Total PAHs | mg/kg | 12 | 1 |
| Phase I and ARSP | -- | R6-30 | 6/9/2016 | 0 - 0.5 ft | Total PAHs | mg/kg | 12 | 1 |
| Phase I and ARSP | -- | SED1.5B | 11/6/2013 | 0 - 0.5 ft | Total PAHs | mg/kg | 14.9 | 1 |
| Phase I and ARSP | -- | SED1.5C | 6/21/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 14 | 1 |
| Phase I and ARSP | -- | SED10C | 11/11/2013 | 0 - 0.5 ft | Total PAHs | mg/kg | 10.8 | 1 |
| Phase I and ARSP | -- | SED4A | 11/12/2013 | 0 - 0.5 ft | Total PAHs | mg/kg | 7.84 | 1 |
| Phase I and ARSP | -- | SED5B | 6/20/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 16 | 1 |
| Phase II | Cove | SED6.5D | 6/9/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 8.3 | 1 |
| Phase II | Cove | SED6.5E | 6/8/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 10 | 1 |
| Phase II | Channel | SED6A | 6/8/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 12 | 1 |
| Phase II | Channel | SED6B | 6/8/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 9.5 | 1 |
| Phase II | Channel | SED6C | 6/7/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 9.3 | 1 |
| Phase II | Cove | SED7.5D | 6/9/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 13 | 1 |
| Phase II | Cove | SED7.5E | 6/8/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 16 | 1 |
| Phase II | Channel | SED7A | 6/9/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 10 | 1 |
| Phase II | Channel | SED7B | 6/7/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 9.4 | 1 |
| Phase II | Cove | SED7D | 6/9/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 13 | 1 |
| Phase II | Cove | SED7E | 6/8/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 12 | 1 |
| Phase II | Cove | SED7F | 6/8/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 12 | 1 |
| Phase II | Channel | SED8A | 6/9/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 11 | 1 |
| Phase II | Channel | SED8B | 6/9/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 9 | 1 |
| Phase II | Channel | SED8C | 6/7/2017 | 0 - 0.33 ft | Total PAHs | mg/kg | 12 | 1 |
| Phase I and ARSP | -- | SED7G | 1/30/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.0013 | 0 |
| Phase I and ARSP | -- | R5-03 | 7/25/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.0067 | 1 |
| Phase I and ARSP | -- | R5-04 | 7/28/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.0064 | 1 |
| Phase I and ARSP | -- | R5-05 | 7/30/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.0089 | 1 |
| Phase I and ARSP | -- | R5-06 | 4/30/2015 | 0 - 0.5 ft | DDE | mg/kg | 0.0035 | 1 |
| Phase I and ARSP | -- | R5-08 | 6/9/2016 | 0 - 0.5 ft | DDE | mg/kg | 0.014 | 1 |
| Phase I and ARSP | -- | R6-01 | 8/5/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.0045 | 1 |
| Phase I and ARSP | -- | R6-02 | 7/28/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.005 | 1 |
| Phase I and ARSP | -- | R6-03 | 7/28/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.02 | 1 |
| Phase I and ARSP | -- | R6-06 | 8/4/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.00575 | 1 |
| Phase I and ARSP | -- | R6-07 | 7/30/2014 | 0 - 0.5 ft | DDE | mg/kg | 0.0019 | 1 |
| Phase I and ARSP | -- | R6-18 | 4/30/2015 | 0 - 0.5 ft | DDE | mg/kg | 0.007 | 1 |
| Phase I and ARSP | -- | R6-22 | 4/30/2015 | 0 - 0.5 ft | DDE | mg/kg | 0.0056 | 1 |
| Phase I and ARSP | -- | R6-23 | 4/30/2015 | 0 - 0.5 ft | DDE | mg/kg | 0.0046 | 1 |
| Phase I and ARSP | -- | R6-30 | 6/9/2016 | 0 - 0.5 ft | DDE | mg/kg | 0.01 | 1 |

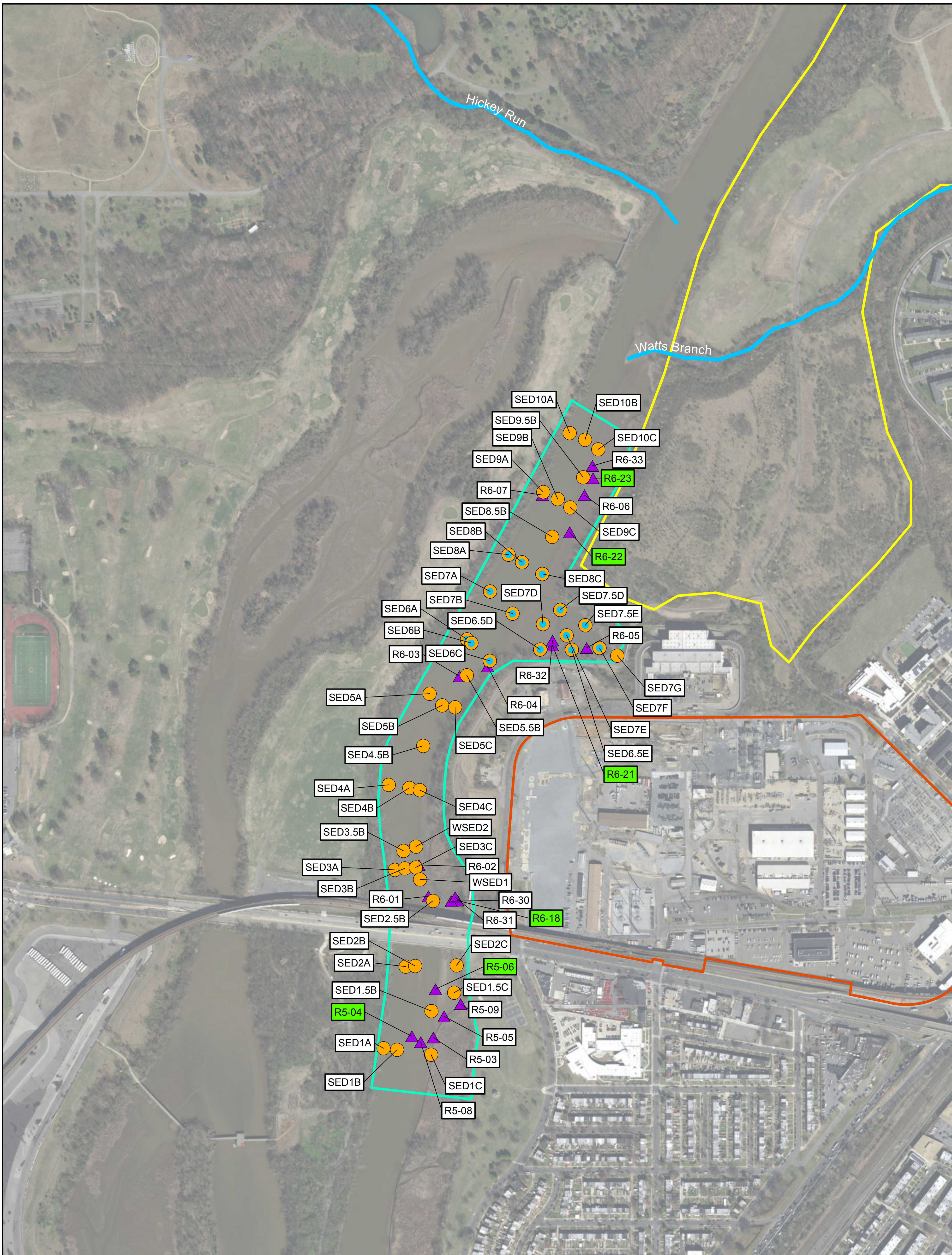
## Attachment K Table 1
## Waterside Investigation Area Surface Sediment Samples Included in Statistical Comparisons

| Source | Location of Phase II Samples | Location | Collected | Depth | Chemical | Units | Result | Detect |
|---|---|---|---|---|---|---|---|---|
| Phase I and ARSP | -- | R6-31 | 6/28/2016 | 0 - 0.5 ft | DDE | mg/kg | 0.0083 | 1 |
| Phase I and ARSP | -- | R6-33 | 6/28/2016 | 0 - 0.5 ft | DDE | mg/kg | 0.0031 | 1 |
| Phase I and ARSP | -- | SED10B | 11/11/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.0038 | 1 |
| Phase I and ARSP | -- | SED1B | 11/6/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.0014 | 1 |
| Phase I and ARSP | -- | SED2C | 11/6/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.0065 | 1 |
| Phase I and ARSP | -- | SED3C | 11/7/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.0034 | 1 |
| Phase I and ARSP | -- | SED4B | 11/12/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.026 | 1 |
| Phase I and ARSP | -- | SED9C | 11/11/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.0071 | 1 |
| Phase I and ARSP | -- | WSED1 | 11/15/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.008 | 1 |
| Phase I and ARSP | -- | WSED2 | 11/15/2013 | 0 - 0.5 ft | DDE | mg/kg | 0.013 | 1 |
| Phase II | Cove | SED6.5D | 6/9/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0058 | 1 |
| Phase II | Cove | SED6.5E | 6/8/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0061 | 1 |
| Phase II | Channel | SED6A | 6/8/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0065 | 1 |
| Phase II | Channel | SED6B | 6/8/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0039 | 1 |
| Phase II | Channel | SED6C | 6/7/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.02 | 1 |
| Phase II | Cove | SED7.5D | 6/9/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0061 | 1 |
| Phase II | Cove | SED7.5E | 6/8/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.01 | 1 |
| Phase II | Channel | SED7A | 6/9/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0056 | 1 |
| Phase II | Channel | SED7B | 6/7/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.04 | 1 |
| Phase II | Cove | SED7D | 6/9/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0083 | 1 |
| Phase II | Cove | SED7E | 6/8/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0042 | 1 |
| Phase II | Cove | SED7F | 6/8/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0051 | 1 |
| Phase II | Channel | SED8A | 6/9/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.0061 | 1 |
| Phase II | Channel | SED8B | 6/9/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.004 | 1 |
| Phase II | Channel | SED8C | 6/7/2017 | 0 - 0.33 ft | DDE | mg/kg | 0.013 | 1 |
| Phase I and ARSP | -- | R5-03 | 7/25/2014 | | Percent Fines | % | 37.8 | 1 |
| Phase I and ARSP | -- | R5-04 | 7/28/2014 | | Percent Fines | % | 47.2 | 1 |
| Phase I and ARSP | -- | R5-05 | 7/30/2014 | | Percent Fines | % | 52.4 | 1 |
| Phase I and ARSP | -- | R5-06 | 4/30/2015 | | Percent Fines | % | 37.7 | 1 |
| Phase I and ARSP | -- | R5-08 | 6/9/2016 | | Percent Fines | % | 56.1 | 1 |
| Phase I and ARSP | -- | R6-01 | 8/5/2014 | | Percent Fines | % | 10.5 | 1 |
| Phase I and ARSP | -- | R6-02 | 7/28/2014 | | Percent Fines | % | 38.3 | 1 |
| Phase I and ARSP | -- | R6-03 | 7/28/2014 | | Percent Fines | % | 65.6 | 1 |
| Phase I and ARSP | -- | R6-04 | 7/28/2014 | | Percent Fines | % | 90.7 | 1 |
| Phase I and ARSP | -- | R6-05 | 8/4/2014 | | Percent Fines | % | 16.3 | 1 |
| Phase I and ARSP | -- | R6-06 | 8/4/2014 | | Percent Fines | % | 52.4 | 1 |
| Phase I and ARSP | -- | R6-07 | 7/30/2014 | | Percent Fines | % | 50.5 | 1 |
| Phase I and ARSP | -- | R6-18 | 4/30/2015 | | Percent Fines | % | 38.6 | 1 |
| Phase I and ARSP | -- | R6-21 | 4/29/2015 | | Percent Fines | % | 18.4 | 1 |
| Phase I and ARSP | -- | R6-22 | 4/30/2015 | | Percent Fines | % | 78 | 1 |
| Phase I and ARSP | -- | R6-23 | 4/30/2015 | | Percent Fines | % | 65.6 | 1 |
| Phase I and ARSP | -- | R6-30 | 6/9/2016 | | Percent Fines | % | 84 | 1 |
| Phase I and ARSP | -- | R6-31 | 6/28/2016 | | Percent Fines | % | 91.3 | 1 |
| Phase I and ARSP | -- | R6-32 | 6/28/2016 | | Percent Fines | % | 68.7 | 1 |
| Phase I and ARSP | -- | R6-33 | 6/28/2016 | | Percent Fines | % | 58.2 | 1 |
| Phase II | Cove | SED6.5D | 6/9/2017 | | Percent Fines | % | 37.6 | 1 |
| Phase II | Cove | SED6.5E | 6/8/2017 | | Percent Fines | % | 27.4 | 1 |
| Phase II | Channel | SED6A | 6/8/2017 | | Percent Fines | % | 55.3 | 1 |
| Phase II | Channel | SED6B | 6/8/2017 | | Percent Fines | % | 41 | 1 |
| Phase II | Channel | SED6C | 6/7/2017 | | Percent Fines | % | 83.6 | 1 |
| Phase II | Cove | SED7.5D | 6/9/2017 | | Percent Fines | % | 80.1 | 1 |
| Phase II | Cove | SED7.5E | 6/8/2017 | | Percent Fines | % | 59.3 | 1 |
| Phase II | Channel | SED7A | 6/9/2017 | | Percent Fines | % | 79.2 | 1 |
| Phase II | Channel | SED7B | 6/7/2017 | | Percent Fines | % | 96.9 | 1 |
| Phase II | Cove | SED7D | 6/9/2017 | | Percent Fines | % | 81.7 | 1 |
| Phase II | Cove | SED7E | 6/8/2017 | | Percent Fines | % | 31.2 | 1 |
| Phase II | Cove | SED7F | 6/8/2017 | | Percent Fines | % | 50.1 | 1 |
| Phase II | Channel | SED8A | 6/9/2017 | | Percent Fines | % | 90 | 1 |
| Phase II | Channel | SED8B | 6/9/2017 | | Percent Fines | % | 34.3 | 1 |
| Phase II | Channel | SED8C | 6/7/2017 | | Percent Fines | % | 77.6 | 1 |
| Phase I and ARSP | -- | R5-03 | 7/25/2014 | | TOC | mg/kg | 39000 | 1 |
| Phase I and ARSP | -- | R5-04 | 7/28/2014 | | TOC | mg/kg | 41000 | 1 |
| Phase I and ARSP | -- | R5-05 | 7/30/2014 | | TOC | mg/kg | 37000 | 1 |
| Phase I and ARSP | -- | R5-06 | 4/30/2015 | | TOC | mg/kg | 38000 | 1 |
| Phase I and ARSP | -- | R5-08 | 6/9/2016 | | TOC | mg/kg | 35000 | 1 |
| Phase I and ARSP | -- | R5-09 | 6/28/2016 | | TOC | mg/kg | 63000 | 1 |
| Phase I and ARSP | -- | R6-01 | 8/5/2014 | | TOC | mg/kg | 20000 | 1 |
| Phase I and ARSP | -- | R6-02 | 7/28/2014 | | TOC | mg/kg | 32000 | 1 |
| Phase I and ARSP | -- | R6-03 | 7/28/2014 | | TOC | mg/kg | 39000 | 1 |
| Phase I and ARSP | -- | R6-06 | 8/4/2014 | | TOC | mg/kg | 36000 | 1 |

## Attachment K Table 1
## Waterside Investigation Area Surface Sediment Samples Included in Statistical Comparisons

| Source | Location of Phase II Samples | Location | Collected | Depth | Chemical | Units | Result | Detect |
|---|---|---|---|---|---|---|---|---|
| Phase I and ARSP | -- | R6-07 | 7/30/2014 | | TOC | mg/kg | 26000 | 1 |
| Phase I and ARSP | -- | R6-18 | 4/30/2015 | | TOC | mg/kg | 64000 | 1 |
| Phase I and ARSP | -- | R6-22 | 4/30/2015 | | TOC | mg/kg | 52000 | 1 |
| Phase I and ARSP | -- | R6-23 | 4/30/2015 | | TOC | mg/kg | 38000 | 1 |
| Phase I and ARSP | -- | R6-30 | 6/9/2016 | | TOC | mg/kg | 81000 | 1 |
| Phase I and ARSP | -- | R6-31 | 6/28/2016 | | TOC | mg/kg | 50000 | 1 |
| Phase I and ARSP | -- | R6-33 | 6/28/2016 | | TOC | mg/kg | 42000 | 1 |
| Phase I and ARSP | -- | SED1.5B | 11/6/2013 | | TOC | mg/kg | 37000 | 1 |
| Phase I and ARSP | -- | SED10A | 11/11/2013 | | TOC | mg/kg | 55000 | 1 |
| Phase I and ARSP | -- | SED10B | 11/11/2013 | | TOC | mg/kg | 24000 | 1 |
| Phase I and ARSP | -- | SED10C | 11/11/2013 | | TOC | mg/kg | 37000 | 1 |
| Phase I and ARSP | -- | SED1A | 11/6/2013 | | TOC | mg/kg | 51000 | 1 |
| Phase I and ARSP | -- | SED1B | 11/6/2013 | | TOC | mg/kg | 23000 | 1 |
| Phase I and ARSP | -- | SED1C | 11/7/2013 | | TOC | mg/kg | 25000 | 1 |
| Phase I and ARSP | -- | SED2.5B | 11/7/2013 | | TOC | mg/kg | 23000 | 1 |
| Phase I and ARSP | -- | SED2A | 11/6/2013 | | TOC | mg/kg | 48000 | 1 |
| Phase I and ARSP | -- | SED2B | 11/5/2013 | | TOC | mg/kg | 33000 | 1 |
| Phase I and ARSP | -- | SED2C | 11/6/2013 | | TOC | mg/kg | 35000 | 1 |
| Phase I and ARSP | -- | SED3.5B | 11/12/2013 | | TOC | mg/kg | 8400 | 1 |
| Phase I and ARSP | -- | SED3A | 11/7/2013 | | TOC | mg/kg | 46000 | 1 |
| Phase I and ARSP | -- | SED3B | 11/8/2013 | | TOC | mg/kg | 6300 | 1 |
| Phase I and ARSP | -- | SED3C | 11/7/2013 | | TOC | mg/kg | 43000 | 1 |
| Phase I and ARSP | -- | SED4.5B | 11/8/2013 | | TOC | mg/kg | 43000 | 1 |
| Phase I and ARSP | -- | SED4A | 11/12/2013 | | TOC | mg/kg | 47000 | 1 |
| Phase I and ARSP | -- | SED4B | 11/12/2013 | | TOC | mg/kg | 20000 | 1 |
| Phase I and ARSP | -- | SED4C | 11/12/2013 | | TOC | mg/kg | 56000 | 1 |
| Phase I and ARSP | -- | SED5.5B | 11/12/2013 | | TOC | mg/kg | 58000 | 1 |
| Phase I and ARSP | -- | SED5A | 11/8/2013 | | TOC | mg/kg | 35000 | 1 |
| Phase I and ARSP | -- | SED5B | 11/8/2013 | | TOC | mg/kg | 39000 | 1 |
| Phase I and ARSP | -- | SED5C | 11/11/2013 | | TOC | mg/kg | 31000 | 1 |
| Phase I and ARSP | -- | SED7G | 1/30/2014 | | TOC | mg/kg | 8400 | 1 |
| Phase I and ARSP | -- | SED8.5B | 11/13/2013 | | TOC | mg/kg | 31000 | 1 |
| Phase I and ARSP | -- | SED9.5B | 11/11/2013 | | TOC | mg/kg | 39000 | 1 |
| Phase I and ARSP | -- | SED9A | 11/11/2013 | | TOC | mg/kg | 30000 | 1 |
| Phase I and ARSP | -- | SED9B | 11/11/2013 | | TOC | mg/kg | 35000 | 1 |
| Phase I and ARSP | -- | SED9C | 11/11/2013 | | TOC | mg/kg | 33000 | 1 |
| Phase I and ARSP | -- | WSED1 | 11/15/2013 | | TOC | mg/kg | 50000 | 1 |
| Phase I and ARSP | -- | WSED2 | 11/15/2013 | | TOC | mg/kg | 60000 | 1 |
| Phase II | Cove | SED6.5D | 6/9/2017 | | TOC | mg/kg | 65000 | 1 |
| Phase II | Cove | SED6.5E | 6/8/2017 | | TOC | mg/kg | 70000 | 1 |
| Phase II | Channel | SED6A | 6/8/2017 | | TOC | mg/kg | 83000 | 1 |
| Phase II | Channel | SED6B | 6/8/2017 | | TOC | mg/kg | 21000 | 1 |
| Phase II | Channel | SED6C | 6/7/2017 | | TOC | mg/kg | 96000 | 1 |
| Phase II | Cove | SED7.5D | 6/9/2017 | | TOC | mg/kg | 50000 | 1 |
| Phase II | Cove | SED7.5E | 6/8/2017 | | TOC | mg/kg | 94000 | 1 |
| Phase II | Channel | SED7A | 6/9/2017 | | TOC | mg/kg | 79000 | 1 |
| Phase II | Channel | SED7B | 6/7/2017 | | TOC | mg/kg | 31000 | 1 |
| Phase II | Cove | SED7D | 6/9/2017 | | TOC | mg/kg | 58000 | 1 |
| Phase II | Cove | SED7E | 6/8/2017 | | TOC | mg/kg | 45000 | 1 |
| Phase II | Cove | SED7F | 6/8/2017 | | TOC | mg/kg | 58000 | 1 |
| Phase II | Channel | SED8A | 6/9/2017 | | TOC | mg/kg | 66000 | 1 |
| Phase II | Channel | SED8B | 6/9/2017 | | TOC | mg/kg | 67000 | 1 |
| Phase II | Channel | SED8C | 6/7/2017 | | TOC | mg/kg | 44000 | 1 |

Notes:
-- - Not applicable.
ft - feet.
mg/kg - milligrams per kilogram.
μg/kg - micrograms per kilogram.




LEGEND

- DOEE Sediment Sample Location*
- PEPCO Sediment Sample Location
- PEPCO Sediment and Pore Water Sample Location (2017)**
- Selected Tributaries
- Waterside Investigation Area
- Kenilworth Landfill
- Benning Road Facility Property Boundary

* Samples shaded in green are co-located with sediment bioassays
** Co-located with sediment bioassays and benthic macroinvertebrate community survey samples.

AECOM

0 600 Feet

N S E W

| | |
|---|---|
| BENNING ROAD FACILITY RI/FS PROJECT<br>3400 BENNING RD., NE<br>WASHINGTON, DC 20019 | SURFICIAL SEDIMENT SAMPLE LOCATIONS |
| Date: 4/25/2019 \| Drawn By: KNS \| Checked By: SED | FIGURE 1 |

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# Attachment L

# Preliminary BERA – Surface Water and Groundwater Evaluations

# Contents

## List of Tables



## List of Figures



## Attachment

# 1 Introduction

As detailed in this BERA, all Phase I analytical data are included with the exception of surface water and groundwater as no ecological risks were found for these media in the Preliminary BERA and therefore, they are not further evaluated in this BERA. This attachment presents the surface water and groundwater evaluations conducted for the Preliminary BERA.

# 2 Surface Water and Groundwater Evaluations

This section presents the salient information from the Problem Formulation, Risk Analysis, and Risk Characterizations for the surface water and groundwater evaluations conducted for the Preliminary BERA.

## 2.1 Identification of Assessment Endpoints and Measurement Endpoints

Two assessment and measurement endpoints were selected:

- **Assessment Endpoint 2** – Protection and maintenance of fish communities in aquatic habitats within the Anacostia River typical of comparable upstream aquatic habitats with similar morphology, hydrology, and urban setting.
  - **Measurement Endpoint 2a** – Comparison of surface water concentrations to chronic and acute surface water screening values. Concentrations above the chronic screening values were considered indicative of a potential for ecological risks. Qualitative comparisons between Site surface water concentration data and Site-specific background data were used to distinguish between Site-related and system-wide (e.g., anthropogenic and natural background) conditions.
  - **Measurement Endpoint 2b** – Comparison of groundwater concentrations collected from nearshore monitoring wells to surface water chronic screening values. Site-specific dilution factors were applied to nearshore monitoring well groundwater data to provide a preliminary estimate surface water concentrations at the point of discharge to the River. Concentrations above the surface water screening values were considered indicative of a potential for ecological risks and may warrant further evaluation through Site-specific modeling or additional data collection efforts.

## 2.2 Surface Water Data

Surface water samples were collected at 10 locations in the Waterside Investigation Area and at 10 Site-specific background sampling location between September 23 and October 3, 2013 (**Figure 1**). Samples were collected approximately one foot above the sediment-water interface at each location. All samples were analyzed for total and dissolved metals, PCB Aroclors, 16 PAHs, and hardness. A sub-set of samples was analyzed for oil and grease, Volatile Organic Compounds (VOCs), SVOCs, pesticides, and dioxin/furans.

### 2.3 Groundwater Data

Groundwater monitoring wells were installed on Site between September 22 and October 17, 2014 at 15 locations across the Site at two depths: shallow and deep. Four of these locations were close to the shoreline (**Figure 1**). Two additional monitoring wells, MW08 and MW11, were included at the request of DOEE (DOEE, 2015) for a total of six upper aquifer monitoring well samples and seven lower aquifer monitoring well samples including a field duplicate at MW08B. The analytical data collected at these locations in November 2014 were used to provide an initial evaluation of the potential pathway of groundwater discharge to Anacostia River surface water . All samples were analyzed for total and dissolved metals, PCB Aroclors, 16 PAHs, VOCs, SVOCs, pesticides, and dioxin/furans. As discussed in the RI Report, the Patapsco Formation underlying the Site is divided by a semi-confining layer into an upper water-bearing zone (UWZ) and a lower water-bearing zone (LWZ). Groundwater discharges from the Site to the River were calculated for the UWZ and LWZ at the six pairs of nested waterfront wells (MW-01, -02, -03, -04, -08, and -11), from which dilution attenuation factors (DAFs) were computed. Groundwater flux was computed using Darcy's Law: Q = KIA, where "Q" is discharge (ft$^3$/sec), "K" is hydraulic conductivity (ft/sec), "I" is hydraulic gradient (unitless), and "A" is the area through which the groundwater flows (ft$^2$). For waterfront wells in which aquifer testing was conducted during the RI (MW-01, MW-03, and MW-11), the average calculated K value was used for the wells' hydraulic conductivity. For wells in which aquifer testing was not conducted, the geometric mean of hydraulic conductivities from the three nearest aquifer-tested wells was used. A local hydraulic gradient was calculated for each well using the slope of the plane formed by the low-tide groundwater level in the well and the groundwater levels in two up-gradient wells (three-point problem approach). A unique cross-sectional area was computed for each well based on water-bearing zone thickness at the well (upper or lower) and a length of boundary segment through which groundwater flows to the River.

The DAFs were calculated by dividing the groundwater discharges for each waterfront well by the 7-day, 10-year low streamflow (7Q10) of the River adjacent to the Site (13.9 ft$^3$/sec), estimated using the US Geological Survey (USGS) Maryland StreamStats application, an online GIS tool for estimating streamflows at ungauged locations. The 7Q10 is the lowest 7-day average streamflow that occurs on average once every 10 years. The instream concentrations for each constituent detected in the waterfront wells was calculated by multiplying the groundwater concentrations by the corresponding DAF. The resulting DAFs ranged from 3.8E-06 at MW04A to 2.0E-04 at MW11A for the UWZ and from 4.2E-05 at MW04B to 1.6E-04 at MW08B for the LWZ.

In addition to the well-specific calculations described above, a flow-weighted average concentration was calculated for each chemical to account for upstream surface water contributions and to evaluate if groundwater discharge contributions from the Site will result in surface water concentrations that exceed surface water ESVs. The average of chemical concentrations detected at the Site-specific background locations 1, 2, 3, 4, 5, and 6 was used to represent upstream surface water contributions. The following equation was used to calculate the flow-weighted average concentration for each chemical:

$$\text{Flow-weighted Average Concentration} = \frac{([C_{MW1A}*Q_{MW1A}] + [C_{MW1B}*Q_{MW1B}] + \ldots) + (C_{SWBCK}*7Q10)}{(Q_{MW1A} + Q_{MW1A} + \ldots + 7Q10)}$$

where:

$C_{MW1A}$ = Chemical concentration measured at monitoring well MW1A
$Q_{MW1A}$ = Discharge rate calculated for monitoring well MW1A
$C_{SWBCK}$= Average chemical concentration of upstream background surface water samples 1, 2, 3, 4, 5, and 6
7Q10 = the lowest 7-day average flow that occurs on average once every 10 years

The UWZ and LWZ groundwater concentrations, the estimated in-stream concentrations for each well and the flow-weighted average concentrations are presented in Section 3.4. The calculation of the DAF is provided in **Attachment E**.

## 2.4 Surface Water Screening Values

Surface water ESVs were selected from the following hierarchy of resources to evaluate potential exposure to surface water and to diluted and attenuated groundwater:

- DOEE Water Quality Standards (WQS) for the protection of freshwater aquatic life (DOEE, 2010)
- USEPA Region 3 Freshwater Screening Benchmarks (USEPA, 2006a).
- Literature-based toxicological benchmarks (Suter & Tsao, 1996 and Buchman, 2008).

Acute and chronic ESVs are presented in **Table 1.** Chronic values were selected from the above sources for the identification of COPCs. Inorganic ESVs were based primarily on the dissolved standards presented in the DOEE WQS (2010) with the exception of mercury and selenium for which total phase standards are presented in the DOEE WQS. In addition, EPA conversion factors were used to calculate both total and dissolved ESVs for several hardness dependent constituents (cadmium, chromium, copper, lead, nickel, and zinc).

## 2.5 Surface Water COPC Selection

Surface water COPCs were identified by comparing maximum detected chemical concentrations measured in surface water to applicable chronic ESVs (**Table 1**). Chemicals were identified as COPCs if the maximum concentration was greater than the chronic ESV or because a surface water ESV was not available for a particular COPC. The results of the COPC identification process are presented in **Table 2**. Surface water COPCs include:

- One dissolved metal - barium
- One pesticide - 4,4-DDT

- Two SVOCs: anthracene and pyrene

In addition, two COPCs (carbazole, n-Hexane Extractable Material [HEM; oil and grease]) were identified because no ESVs were available.

## 2.6 Groundwater Screen

**Table 3** presents surface water concentrations estimated from chemicals that were detected in groundwater at each nearshore monitoring well location (both shallow and deep wells). A description of the groundwater-to-surface water calculations is presented in **Attachment E**.

None of the Estimated surface water concentrations were greater than the surface water ESVs with the exception of the TCDD TEQ concentration (0.00003 μg/L) calculated for MW11B (lower aquifer), which exceeds the surface water ESV of 0.00001 μg/L. However, this elevated TCDD TEQ concentration is likely attributable to turbidity and not likely representative of dissolved concentrations that are mobile and have the potential to migrate. Pepco will re-develop and re-sample MW-11 to address the turbidity issues as part of the upcoming additional field investigation. In addition, none of the flow-weighted average concentrations exceed the surface water ESVs. Therefore, although there is some uncertainty with this approach, no groundwater COPCs were identified in this preliminary ERA based on the evaluation of wells with the potential to discharge to the river. In addition, potential risks to benthic organisms exposed to sediment porewater will be further addressed via direct sampling of porewater as part of the upcoming additional field investigation.

### 2.7 Evaluation of Surface Water Chemistry

The COPCs identified for surface water in **Table 2** were screened against both chronic and acute ESVs on a sample-by-sample basis for the Waterside Investigation Area in **Table 4**.

All detected dissolved concentrations of barium, and total concentrations of 4,4'-DDT and anthracene are greater than the chronic ESV, but less than acute ESVs (when an acute ESV is available). For pyrene, three out of four detected concentrations are greater than the chronic ESV; no acute ESV is available.

- **Barium:** All Site dissolved barium concentrations, ranging from 28 µg/L to 36 µg/L, exceed the chronic ESV (4 µg/L), but are less than the acute freshwater ESV (110 µg/L).
- **4,4-DDT:** Concentrations of 4,4-DDT detected in all five Site surface water samples ranged from 0.0011 µg/L to 0.0016 µg/L and are above the chronic ESV (0.0010 µg/L), but less than the acute ESV (1.1 µg/L). Both ESVs are from DOEE WQS (DOEE, 2010).
- **Anthracene:** The concentrations of anthracene detected in one out of 10 Site surface water samples (0.018 µg/L) was above the chronic ESV (0.012 µg/L) from USEPA Region 3, but below the acute ESV (13 µg/L). The reporting limits for the non-detected samples were also higher than the chronic ESV.

**Pyrene**: Concentrations of pyrene detected in three out of 10 Site surface water samples, ranging from 0.026 µg/L to 0.038 µg/L, are higher than the chronic ESV (0.025 µg/L) from USEPA Region 3. The reporting limits for pyrene are also higher than the chronic ESV. No acute ESV is available for pyrene.

### 2.8 Uncertainty Evaluation

The following sections address uncertainties specifically related to the surface water and groundwater evaluations.

#### 2.8.1 Uncertainties - Surface Water Background Evaluation

A comparison of Site and Background surface water was conducted (presented in Appendix X of the RI Report) and a summary is presented below. Similar to the Study Area, nearly all detected background concentrations of COPCs are greater than the chronic ESV, but less than acute ESVs, when an acute ESV is available. Boxplot comparisons, population test comparisons, and BTV comparisons of surface water concentrations for COPCs in the Study Area and at the ten Site-specific background locations are presented in Appendix X of the RI report. The range of Study Area concentrations of dissolved barium, 4,4-DDT, anthracene and pyrene (i.e., the only COPCs that exceed chronic ESVs) are very similar to or lower than the Site-specific background ranges.

- **Dissolved Barium**: Concentrations in Background samples ranged up to 58 μg/L and also exceed the chronic ESV indicating that background levels of barium are above the chronic ESV. Similar to Study Area concentrations, none of background barium concentrations exceed the acute ESV. Based on the results of the population test (presented in Appendix V), background and Study Area concentrations of barium are similar. In addition, the mean concentration of Study Area barium is less than the BTV.
- **4,4'-DDT**: Concentrations of detected 4,4-DDT in Site-specific background samples exceed the chronic ESV indicating that background levels of 4,4-DDT exceed the ESV.  No Study Area or Background 4,4-DDT concentrations exceed the acute ESV of 1.1 μg/L. The mean concentration of Site 4,4'-DDT is equal to the BTV.
- **Anthracene**: Anthracene was not detected in Background samples.
- **Pyrene**: Similar levels of pyrene were detected in the Background locations, although none at levels higher than the chronic ESV. The mean concentration of pyrene in the Study Area is less than the BTV.

The background evaluation presented above suggests that COPCs are found at similar levels in the Study Area and at the Site-specific Background locations, which suggests that Site-related risks due to COPCs in surface water are not expected.

### 2.8.2 Uncertainties Associated with Surface Water Evaluation

The surface water ESVs were derived from sources typically used in screening level ERAs (e.g., DOEE WQS) and therefore represent conservative values that may overestimate risks. These values are useful in identifying areas or media where no adverse ecological effects would be expected and which can then be eliminated from further consideration. Specific uncertainties with the ESVs are addressed below.

- Barium - The chronic ESV is a USEPA Region 3 freshwater screening benchmark for dissolved barium. This ESV is a Tier II secondary chronic value (SCV) presented by Suter and Tsao (1996) and is based on 16% reproductive impairment at 5,800 μg/L in a 21-day test on *Daphnia magna* (all site concentrations of barium are well below this level). Tier II values are based on a smaller data set than is required to develop an state WQS or AWQC and uncertainty factors are applied to the available data to derive the SCV.  Therefore, the risks predicted based on the chronic ESV for barium may be overestimated.
- 4,4-DDT - The chronic ESV for 4,4-DDT was derived for the NAWQC based on the lowest freshwater tissue residue concentration, which was based on reduced reproductivity for brown pelicans (USEPA, 1980).  The freshwater residue derived for fish was 0.019 μg/L, which is greater

than all concentrations detected in the Waterside Investigation Area. Therefore, the risks predicted based on the chronic ESV for 4,4-DDT may be overestimated.

- Anthracene - The chronic ESV was originally derived by Canadian Council of Ministers of the Environment (CCME, 1999) based on a 24-hourexposure of invertebrates to 1.2 μg/L anthracene which immobilized daphnids after 15 mins exposure at this level. Fish were less sensitive where the lowest 96-hour LC50 value was 4.5 μg/L. CCME derived the interim aquatic life guideline for anthracene as 0.012 μg/L, which is 1.2 μg/L with a safety factor of 0.01 applied. Therefore, the risks predicted based on the chronic ESV for anthracene may be overestimated.
- Pyrene - The chronic ESV was originally derived by Canadian Council of Ministers of the Environment (CCME, 1999) based on an LC50 of 2.5 μg/L for mosquito larvae. CCME derived the interim aquatic life guideline for pyrene as 0.025 μg/L, which is 2.5 μg/L with a safety factor of 0.01 applied. No pyrene concentrations detected at Site locations are higher than 2.5 μg/L. Therefore, the risks predicted based on the chronic ESV for pyrene may be overestimated.

Toxicity data are typically not available for all species considered in an ERA so ESVs based on surrogate species are used. It is assumed that species used to derive the ESVs are protective of other species. However, the inter-species extrapolation of toxicity data produces unknown bias in risk calculations. The selection of conservative values in the ERA (e.g., lowest surface water ESVs) helps to limit this uncertainty.

ESVs are often based on studies conducted in the laboratory and may not accurately represent field conditions. Chemical forms of COPCs used in toxicity testing may be more bioavailable than the COPCs found in the field and lab conditions are unlikely to represent the variable conditions found in the field. This extrapolation represents an unknown source of bias in the ERA.

ESVs used in this ERA are based on chronic effects to analyze the potential for ecological risk to freshwater fish communities. Chronic toxicity values were used because it was assumed that surface water and sediment indicator species would experience continuous exposures within the aquatic exposure area. The assumption of chronic exposure may be realistic for the sediment-associated species (i.e., amphipods) and small juvenile fish, but is likely conservative for surface water species (i.e., adult fish) which may forage over greater distances, particularly in the Anacostia River. The surface water ESVs are also designed to be protective of sensitive species which may not be present within the Waterside Investigation Area; therefore, this may result in an overestimate of potential toxicity for many aquatic organisms.

In general, PAHs are hydrophobic and likely to sorb onto solid phases in aquatic environments. It is likely that the PAHs detected in the surface water are present on particulate matter within the water column and not present in the dissolved phase; thus, the PAHs are likely less bioavailable and toxic. Therefore, it is expected that the comparison of surface water PAHs, such as anthracene and pyrene, concentrations against the chronic ESVs likely over-estimates risks to aquatic receptors.

### 2.8.3 Uncertainties Associated with Groundwater Evaluation

The groundwater discharge to surface water ESVs were derived from sources typically used in screening level ERAs and therefore represent conservative values that may overestimate risks. These values are useful in identifying areas or media where no adverse ecological effects would be expected and which can then be eliminated from further consideration.

Uncertainties related to the site characterization of groundwater evaluation include the representativeness of groundwater discharging to surface water at the six nearshore monitoring wells. In addition, DAF values calculated specifically for each shallow (UWZ) and deep (LWZ) well were applied to all detected compounds. It is uncertain whether those values are applicable to all chemical compounds as each compound will vary in ability sorb and desorb. The DAF calculations also assume an instantaneous dilution of groundwater within the entire water column which may not be realistic for all chemicals. It is more likely that groundwater would mix gradually with surface water and full dilution would occur downstream of the Site. A reduced DAF would increase estimated concentrations. Therefore, the DAFs used in this evaluation may underestimate potential surface water concentrations.

Uncertainties associated with the groundwater evaluation could be better understood through collection of Site-specific pore water data.

## 2.9 Summary and Conclusions

This section presents a summary of the preliminary ERA findings specifically related to the surface water and groundwater evaluations.

**Assessment Endpoint: Protection of Fish Community:**

1. The maximum concentrations of one metal (dissolved barium), one pesticide (4,4-DDT), and two VOCs (anthracene and pyrene) were identified as COPCs. No other consituents in surface water exceeded low effect (chronic) ESVs. These compounds were also present at the background locations at concentrations in excess of chronic ESVs with the exception of pyrene.
2. No detected Waterside Investigation Area COPC concentrations exceed the acute ESVs.
3. The range of Study Area and Background surface water concentrations are similar.
4. No COPCs were identified in Site groundwater discharging to Anacostia River surface water and no significant risks to the aquatic community via this pathway were identified.

Based on this analysis there is limited potential for ecological risks to the fish community in the Waterside Investigation Area on the basis of surface water or groundwater exposure pathways. Therefore, these pathways were not identified as data gaps requiring additional data or analysis in the BERA.

# 3 References


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# Tables

Table 1
Surface Water Ecological Screening Values
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| Detected Chemical | Chronic ESV (a) | Chronic ESV Source | Acute ESV (b) | Acute ESV Source |
|---|---|---|---|---|
| **INORGANICS - DISSOLVED PHASE** | | | | |
| Antimony | 30 | USEPA, 2006 | nCOPC | |
| Arsenic | 150 | DOH, 2010 | nCOPC | |
| Barium | 4 | USEPA, 2006 | 110 | Buchman, 2008 |
| Beryllium | 0.66 | USEPA, 2006 | nCOPC | |
| Calcium | 116000 | USEPA, 2006 | nCOPC | |
| Chromium | 11.0 (d) | DOH, 2010 | nCOPC | |
| Cobalt | 23 | USEPA, 2006 | nCOPC | |
| Copper | 5.79 (c) | DOH, 2010 | nCOPC | |
| Iron | 1000 | DOH, 2010 | nCOPC | |
| Magnesium | 82000 | USEPA, 2006 | nCOPC | |
| Manganese | 120 | USEPA, 2006 | nCOPC | |
| Nickel | 33.8 (c) | DOH, 2010 | nCOPC | |
| Potassium | 53000 | USEPA, 2006 | nCOPC | |
| Silver | 1.34 (c,e) | DOH, 2010 | nCOPC | |
| Sodium | 680000 | USEPA, 2006 | nCOPC | |
| Vanadium | 20 | USEPA, 2006 | nCOPC | |
| Zinc | 76.6 (c) | DOH, 2010 | nCOPC | |
| **INORGANICS - TOTAL RECOVERABLE PHASE** | | | | |
| Selenium | 5 | DOH, 2010 | nCOPC | |
| Thallium | 0.8 | USEPA, 2006 | nCOPC | |
| **PESTICIDES** | | | | |
| 4,4'-DDT | 0.001 | DOH, 2010 | 1.1 | DOH, 2010 |
| beta-BHC | 2.2 (f,g) | USEPA, 2006 | nCOPC | |
| delta-BHC | 141 (f) | USEPA, 2006 | nCOPC | |
| Endosulfan sulfate | 0.056 (h) | DOH, 2010 | nCOPC | |
| gamma-Chlordane | 0.0022 (f,i) | USEPA, 2006 | nCOPC | |
| Heptachlor epoxide | 0.0038 | DOH, 2010 | nCOPC | |
| **POLYCHLORINATED BIPHENYLs** | | | | |
| Total PCBs | 0.014 | DOH, 2010 | nCOPC | |
| **SEMI-VOLATILE ORGANIC COMPOUNDS** | | | | |
| 1,1'-Biphenyl | 14 (f) | USEPA, 2006 | nCOPC | |
| 2-Methylnaphthalene | 4.7 (f) | USEPA, 2006 | nCOPC | |
| 4-Methylphenol | 543 | USEPA, 2006 | nCOPC | |
| Bis(2-ethylhexyl) phthalate | 16 | USEPA, 2006 | nCOPC | |
| Butylbenzylphthalate | 19 (f) | USEPA, 2006 | nCOPC | |
| Carbazole | NV | | nCOPC | |
| Dibenzofuran | 3.7 (f) | USEPA, 2006 | nCOPC | |
| Di-n-butylphthalate | 19 | USEPA, 2006 | nCOPC | |
| Pentachlorophenol | 5.10 (j) | DOH, 2010 | nCOPC | |
| Phenol | 4 | USEPA, 2006 | nCOPC | |
| Acenaphthene | 50 | DOH, 2010 | nCOPC | |
| Acenaphthylene | 4840 | Buchman, 2006 | nCOPC | |
| Anthracene | 0.012 | USEPA, 2006 | 13 | Suter and Tsao, 1996 |
| Fluoranthene | 400 | DOH, 2010 | nCOPC | |
| Fluorene | 3 | USEPA, 2006 | nCOPC | |
| Naphthalene | 600 | DOH, 2010 | nCOPC | |
| Phenanthrene | 0.4 | USEPA, 2006 | nCOPC | |
| Pyrene | 0.025 | USEPA, 2006 | NV | |
| **VOLATILE ORGANIC COMPOUNDS** | | | | |
| 2-Butanone | 14000 (f) | USEPA, 2006 | nCOPC | |
| Acetone | 1500 (f) | USEPA, 2006 | nCOPC | |
| Bromodichloromethane | NV | | nCOPC | |
| Carbon disulfide | 0.92 (f) | USEPA, 2006 | nCOPC | |
| Chloroform | 3000 | DOH, 2010 | nCOPC | |
| cis-1,2-Dichloroethene | NV | | nCOPC | |
| Dibromochloromethane | NV | | nCOPC | |
| Methyl tert-butyl ether | 11070 (f) | USEPA, 2006 | nCOPC | |
| Tetrachloroethene | 800 | DOH, 2010 | nCOPC | |
| Toluene | 600 | DOH, 2010 | nCOPC | |
| Trichloroethene | 21 | Buchman, 2008 | nCOPC | |
| **DIOXIN/FURANs** | | | | |
| TCDD TEQ Fish | 0.00001 (k) | Buchman, 2008 | nCOPC | |

**Notes:**
All units are in micrograms per liter (μg/L).
Acute ESV - Acute Ecological Screening Value.
Chronic ESV - Chronic Ecological Screening Value.
COPC - Chemical of Potential Concern.
nCOPC - Not identified as a COPC following the screen comparing chronic ESVs to maximum detected concentrations.
NV - No value.
SAV - Secondary Acute Value (Suter and Tsao, 1996).
ESVs are presented for detected chemicals only in surface water and groundwater.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DDOE WQS Criteria (DOH, 2010), USEPA Region 3 freshwater sediment screening values (USEPA, 2006), and literature values (Suter and Tsao 1996, Buchman 2008).
(b) Acute ESVs selected based on freshwater acute criteria available from DDOE (DOH, 2010), Buchman (2008), and Suter and Tsao (1996; SAV).

(c) Hardness dependent criteria. Value presented has been adjusted by a mean hardness of 60 mg/L as $CaCO_3$ for the Waterside Investigation Area.
(d) Value for Hexavalant Chromium used.
(e) Value based on acute water quality criteria.
(f) Value is for dissolved concentration.
(g) Value for BHC (non-Lindane) is used as a surrogate due to structural similarities.
(h) Value for endosulfan used due to structural similarities.
(i) Value for chlordane used as a surrogate due to structural similarities.
(j) Value for pentachlorophenol adjusted by mean pH of 6.73 for the Waterside Investigation Area.
(k) Chronic freshwater value (Buchman 2006).

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# Table 2
## Identification of Surface Water COPCs
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| Detected Analyte | FOD | Detected Concentrations | | | Chronic ESV (a) | | COPC Determination and Rationale | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|
| | | Minimum | Mean | Maximum | | | | |
| **INORGANICS - DISSOLVED** | | | | | | | | |
| Antimony | 10 : 10 | 0.74 | 0.93 | 1.8 | 30 | | No - Max detect < ESV | NCOPC |
| Arsenic | 7 : 10 | 0.32 | 0.49 | 0.64 | 150 | | No - Max detect < ESV | NCOPC |
| Barium | 10 : 10 | 28 | 33 | 36 | 4 | | Yes - Max detect > ESV | 9.0 |
| Beryllium | 5 : 10 | 0.037 | 0.05 | 0.079 | 0.66 | | No - Max detect < ESV | NCOPC |
| Calcium | 10 : 10 | 14000 | 16000 | 19000 | 116000 | | EN | NCOPC |
| Chromium | 10 : 10 | 1.6 | 1.9 | 2.3 | 11 | | No - Max detect < ESV | NCOPC |
| Cobalt | 10 : 10 | 0.093 | 0.28 | 0.71 | 23 | | No - Max detect < ESV | NCOPC |
| Copper | 10 : 10 | 1.7 | 2.5 | 3.9 | 5.8 | (b) | No - Max detect < ESV | NCOPC |
| Iron | 5 : 10 | 8.9 | 12 | 18 | 1000 | | No - Max detect < ESV | NCOPC |
| Magnesium | 10 : 10 | 3700 | 4700 | 5800 | 82000 | | EN | NCOPC |
| Manganese | 8 : 10 | 29 | 54 | 77 | 120 | | No - Max detect < ESV | NCOPC |
| Nickel | 10 : 10 | 1.5 | 2.1 | 2.5 | 33.8 | (b) | No - Max detect < ESV | NCOPC |
| Potassium | 10 : 10 | 3100 | 3500 | 3800 | 53000 | | EN | NCOPC |
| Silver | 1 : 10 | 0.062 | 0.062 | 0.062 | 1.3 | (b) | No - Max detect < ESV | NCOPC |
| Sodium | 10 : 10 | 15000 | 18000 | 20000 | 680000 | | EN | NCOPC |
| Vanadium | 7 : 10 | 0.14 | 0.37 | 1 | 20 | | No - Max detect < ESV | NCOPC |
| Zinc | 10 : 10 | 4 | 7.4 | 12 | 76.6 | (b) | No - Max detect < ESV | NCOPC |
| **INORGANICS - TOTAL** | | | | | | | | |
| Selenium | 2 : 10 | 0.5 | 0.68 | 0.86 | 5 | | No - Max detect < ESV | NCOPC |
| Thallium | 10 : 10 | 0.015 | 0.045 | 0.1 | 0.8 | | No - Max detect < ESV | NCOPC |
| **PESTICIDES** | | | | | | | | |
| 4,4'-DDT | 5 : 5 | 0.0011 | 0.0013 | 0.0016 | 0.001 | | Yes - Max detect > ESV | 1.6 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS** | | | | | | | | |
| 2-Methylnaphthalene | 1 : 5 | 0.016 | 0.016 | 0.016 | 4.7 | | No - Max detect < ESV | NCOPC |
| Anthracene | 1 : 10 | 0.018 | 0.018 | 0.018 | 0.012 | | Yes - Max detect > ESV | 1.5 |
| bis-(2-Ethylhexyl)phthalate | 3 : 5 | 1.4 | 1.9 | 2.2 | 16 | | No - Max detect < ESV | NCOPC |
| Butylbenzylphthalate | 1 : 5 | 0.86 | 0.86 | 0.86 | 19 | | No - Max detect < ESV | NCOPC |
| Carbazole | 1 : 5 | 0.037 | 0.037 | 0.037 | NV | | Yes - No ESV | NC |
| Di-n-butylphthalate | 1 : 5 | 0.49 | 0.49 | 0.49 | 19 | | No - Max detect < ESV | NCOPC |
| Fluoranthene | 6 : 10 | 0.019 | 0.029 | 0.036 | 400 | | No - Max detect < ESV | NCOPC |
| Pyrene | 4 : 10 | 0.021 | 0.03 | 0.038 | 0.025 | | Yes - Max detect > ESV | 1.5 |
| **VOLATILE ORGANIC COMPOUNDS** | | | | | | | | |
| Carbon Disulfide | 1 : 5 | 0.40 | 0.40 | 0.40 | 0.92 | | No - Max detect < ESV | NCOPC |
| Toluene | 1 : 5 | 0.15 | 0.15 | 0.15 | 600 | | No - Max detect < ESV | NCOPC |
| **DIOXIN/FURANs** | | | | | | | | |
| TCDD TEQ Fish | 5 : 5 | 7.44E-08 | 2.70E-07 | 4.25E-07 | 1.00E-05 | | No - Max detect < ESV | NCOPC |

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**Table 2**
**Identification of Surface Water COPCs**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Detected Analyte | FOD | Detected Concentrations | | | Chronic ESV (a) | COPC Determination and Rationale | Hazard Quotient |
|---|---|---|---|---|---|---|---|
| | | Minimum | Mean | Maximum | | | |
| **PETROLEUM HYDROCARBONS** | | | | | | | |
| HEM (Oil and Grease) | 5 : 5 | 1700 | 1900 | 2200 | NV | Yes - No ESV | NC |

Notes:
All units are in micrograms per liter (µg/L).
Hazard quotient is calculated by dividing the maximum detected concentration by the ESV.
COPC - Constituent of Potential Concern.
DDOE - District of Columbia Department of Environment.
EN - Essential Nutrient.
ESV - Ecological Screening Value.
FOD - Frequency of Detection.
HEM - N-Hexane Extractable Material.
NC - Not Calculated.
NCOPC - Not a COPC.
NV - No Value.
PAH - Polycyclic Aromatic Hydrocarbon.
TCDD TEQ - Tetrachlorodibenzo-p-dioxin toxic equivalence.
USEPA - United States Environmental Protection Agency.
WQS - Water Quality Standards.
(a) Chronic ESVs selected based on a hierarchy of water quality standards and benchmarks from DOEE WQS (DOEE, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and othre literature values (Suter and Tsao 1996, Buchman 2008). See Table 3-2.
(b) Value presented has been adjusted by a hardness of 60 mg/L as $CaCO_3$ for the Waterside Investigation Area.

Table 3
Evaluation of the Groundwater to Surface Water Migration Pathway
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | Nearshore Groundwater Wells - Upper Aquifer | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location ID | MW01 | | MW02 | | MW03 | | MW04 | | MW08 | | MW11 | |
| Sample ID | MW01AN | | MW02AN | | MW03AN | | MW04AN | | MW08AN | | MW11AN | |
| Sample Date | 11/5/2014 | | 11/5/2014 | | 11/4/2014 | | 11/4/2014 | | 11/10/2014 | | 11/4/2014 | |
| **Chemical (d)** | | | | | | | | | | | | |
| **DIOXIN TEQs** | | | | | | | | | | | | |
| TCDD TEQ Fish | 2.76E-08 | | NA | | 1.25E-09 | | 1.20E-08 | | NA | | 4.23E-02 | |
| **INORGANICS - DISSOLVED PHASE** | | | | | | | | | | | | |
| Arsenic | 1 | U | 2.3 | | 1.2 | | 1 | U | 1.2 | | 1 | U |
| Barium | 180 | | 16 | | 92 | | 86 | | 58 | | 38 | |
| Beryllium | 1 | UJ | 1 | U | 1 | U | 1 | UJ | 1 | U | 1 | U |
| Calcium | 72000 | | 50000 | | 37000 | | 57000 | | 38000 | | 20000 | |
| Cobalt | 8.5 | | 0.5 | U | 5.8 | | 30 | | 5.3 | | 2.2 | |
| Iron | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U |
| Magnesium | 11000 | | 5000 | | 4300 | | 15000 | | 7300 | | 4100 | |
| Manganese | 3800 | | 200 | | 3800 | | 5000 | | 1300 | | 430 | |
| Nickel | 0.28 | J- | 0.41 | J | 3 | | 5.7 | | 2 | | 1.1 | |
| Potassium | 6200 | | 7400 | | 5900 | | 6800 | | 6000 | | 4000 | |
| Sodium | 100000 | | 96000 | | 42000 | | 160000 | | 26000 | | 14000 | |
| Thallium | 1 | U | 1 | U | 1 | U | 1 | U | 0.043 | J | 1 | U |
| Vanadium | 4.7 | J+ | 6.5 | J+ | 4.5 | J+ | 2.6 | J | 4.1 | J+ | 5.8 | J+ |
| Zinc | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| **INORGANICS - TOTAL RECOVERABLE PHASE** | | | | | | | | | | | | |
| Thallium | 1 | U | 1 | U | 1 | U | 1 | U | 0.043 | J | 1 | U |
| **PESTICIDES** | | | | | | | | | | | | |
| 4,4'-DDE | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| 4,4'-DDT | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| beta-BHC | 0.0012 | U | 0.0013 | U | 0.00095 | J | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| delta-BHC | 0.0012 | U | 0.0004 | J | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| Endosulfan Sulfate | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| Endrin | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| Heptachlor Epoxide | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| trans-Chlordane | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0012 | U |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | | | | | | | | | | | | |
| Total PCBs (Aroclors) | 0.0095 | U | 0.0096 | U | 0.0095 | U | 0.0098 | U | 0.0097 | U | 0.0095 | U |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | | | | |
| 1,1'-Biphenyl | 1 | U | 0.27 | J | 1 | U | 1.1 | U | 1 | U | 1 | U |
| 2-Methylnaphthalene | 0.029 | J | 1.2 | | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |
| 4-Methylphenol | 0.33 | J | 0.96 | U | 1 | U | 1.1 | U | 1 | U | 1 | U |
| 4-Nitrophenol | 5 | U | 4.8 | U | 5.2 | U | 5.4 | U | 5 | U | 5 | U |
| Acenaphthene | 0.2 | U | 1.3 | | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |
| Acenaphthylene | 0.2 | U | 0.086 | J | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |
| Anthracene | 0.2 | U | 0.044 | J | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |
| Carbazole | 1 | U | 0.27 | J | 1 | U | 1.1 | U | 1 | U | 1 | U |
| Dibenzofuran | 1 | U | 0.71 | J | 1 | U | 1.1 | U | 1 | U | 1 | U |
| Fluoranthene | 0.2 | U | 0.088 | J | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |
| Fluorene | 0.2 | U | 0.64 | | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |
| Naphthalene | 0.2 | | 13 | J | 0.21 | U | 0.22 | U | 0.046 | J | 0.2 | U |
| Pentachlorophenol | 1 | U | 0.96 | U | 1 | U | 1.1 | U | 1 | U | 1 | U |
| Phenanthrene | 0.2 | U | 0.67 | | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |
| Phenol | 0.57 | J | 0.96 | U | 1 | U | 1.1 | U | 1 | U | 1 | U |
| Pyrene | 0.2 | U | 0.042 | J | 0.21 | U | 0.22 | U | 0.2 | U | 0.2 | U |

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**Table 3**
**Evaluation of the Groundwater to Surface Water Migration Pathway**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | Nearshore Groundwater Wells - Upper Aquifer | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location ID** | **MW01** | | **MW02** | | **MW03** | | **MW04** | | **MW08** | | **MW11** | |
| **Sample ID** | **MW01AN** | | **MW02AN** | | **MW03AN** | | **MW04AN** | | **MW08AN** | | **MW11AN** | |
| **Sample Date** | **11/5/2014** | | **11/5/2014** | | **11/4/2014** | | **11/4/2014** | | **11/10/2014** | | **11/4/2014** | |
| **Chemical (d)** | | | | | | | | | | | | |
| **VOLATILE ORGANIC COMPOUNDS (VOCs)** | | | | | | | | | | | | |
| 2-Butanone | 5 | U | 5 | U | 7.5 | | 5 | U | 5 | U | 5 | U |
| Acetone | 5 | U | 5 | U | 4.1 | J | 5 | U | 5 | U | 5 | U |
| Benzene | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Bromodichloromethane | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Carbon Disulfide | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | |
| Chloroform | 1 | U | 1 | U | 1.2 | | 0.22 | J | 1.2 | | 1 | U |
| cis-1,2-Dichloroethylene | 0.92 | J | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Dibromochloromethane | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Methyl tert-Butyl Ether (MTBE) | 1.6 | | 1 | U | 1 | U | 0.29 | J | 1 | U | 1 | U |
| Methylene Chloride | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Tetrachloroethylene | 4.4 | | 2.3 | | 0.32 | J | 0.25 | J | 1 | U | 0.18 | J |
| Toluene | 1 | U | 1 | U | 0.34 | J | 1 | U | 1 | U | 1 | U |
| Trichloroethene | 0.43 | J | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |

Notes:
All units are in µg/L.
DAF - Dilution Attenuation Factor.
ESV - Ecological Screening Value.
J - Estimated value.
NA - Not analyzed.
NC - Not calculated.
NV - No Value.
TCDD TEQ - Dioxin Toxicity Equivalence.
U - Not detected above the laboratory reporting limit.
UJ - Not detected above laboratory reporting limit; Estimated value.
+/- Likely to have a high (+) or low (-) bias.
(a) Surface water concentrations were estimated by multiplying groundwater results from the nearshore monitoring wells by well-specific dilution attenuation factor (DAF). DAFs were derived separately for the upper and lower aquifers for each well.
(b) See Table 3-2 for specific source of screening level and surrogate used (if applicable).
(c) The flow-weighted average concentration is calculated using the following equation:

$$\frac{([CMW1A*QMW1A]+[CMW1B*QMW1B]+\ldots)+(CSWBCK*7Q10)}{(QMW1A+QMW1A+\ldots+7Q10)}$$

where:
CMW1A = Chemical concentration measured at monitoring well MW1A
QMW1A = Discharge rate calculated for monitoring well MW1A
CSWBCK= Average chemical concentration of upstream background surface water samples 1, 2, 3, 4, 5, and 6 (presented in Appendix J.
7Q10 = the lowest 7-day average flow that occurs on average once every 10 years
(d) Only chemicals detected at least once in nearshore groundwater monitoring wells are presented.

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**Table 3**
**Evaluation of the Groundwater to Surface Water Migration Pathway**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | Nearshore Groundwater Wells - Lower Aquifer | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location ID** | **MW01** | | **MW02** | | **MW03** | | **MW04** | | **MW08** | | **MW08** | | **MW11** | |
| **Sample ID** | **MW01BN** | | **MW02BN** | | **MW03BN** | | **MW04BN** | | **MW08BN** | | **MW08BR** | | **MW11BN** | |
| **Sample Date** | **11/5/2014** | | **11/5/2014** | | **11/4/2014** | | **11/4/2014** | | **11/5/2014** | | **11/5/2014** | | **11/4/2014** | |
| **Chemical (d)** | | | | | | | | | | | | | | |
| **DIOXIN TEQs** | | | | | | | | | | | | | | |
| TCDD TEQ Fish | 2.37E-09 | | NA | | 2.83E-09 | | 2.53E-06 | U | NA | | NA | | 2.57E-01 | |
| **INORGANICS - DISSOLVED PHASE** | | | | | | | | | | | | | | |
| Arsenic | 1 | U | 1 | U | 0.48 | J | 0.91 | J | 0.31 | J | 1 | U | 2.2 | |
| Barium | 190 | | 75 | | 150 | | 100 | | 140 | | 130 | | 120 | |
| Beryllium | 1 | UJ | 0.51 | J | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Calcium | 30000 | | 12000 | | 20000 | | 25000 | | 17000 | | 16000 | | 29000 | |
| Cobalt | 8.2 | | 26 | | 1.9 | | 1.9 | | 0.83 | | 0.75 | | 0.2 | J |
| Iron | 5800 | J | 30000 | J | 190 | J | 570 | J | 50 | U | 50 | U | 50 | |
| Magnesium | 13000 | | 4800 | | 6100 | | 7900 | | 6400 | | 5700 | | 6800 | |
| Manganese | 3400 | | 1600 | | 530 | | 950 | | 280 | | 250 | | 360 | |
| Nickel | 4.3 | J- | 11 | | 1.2 | | 1.6 | | 0.87 | J | 0.67 | J | 0.33 | J |
| Potassium | 5000 | | 2400 | | 2700 | | 3600 | | 3900 | | 3500 | | 9700 | |
| Sodium | 120000 | | 36000 | | 13000 | | 18000 | | 19000 | | 17000 | | 46000 | |
| Thallium | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Vanadium | 3.2 | J | 3.5 | J+ | 2.5 | J+ | 1.4 | J+ | 1 | U | 4.2 | J+ | 3.8 | J+ |
| Zinc | 5.4 | U | 39 | | 7.5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| **INORGANICS - TOTAL RECOVERABLE PHASE** | | | | | | | | | | | | | | |
| Thallium | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| **PESTICIDES** | | | | | | | | | | | | | | |
| 4,4'-DDE | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.001 | J | 0.0013 | U |
| 4,4'-DDT | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0042 | | 0.0037 | | 0.0028 | |
| beta-BHC | 0.0013 | U | 0.0011 | J | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0013 | U |
| delta-BHC | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0013 | U | 0.0013 | U |
| Endosulfan Sulfate | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.00073 | J | 0.0013 | U | 0.0013 | U | 0.0013 | U |
| Endrin | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0012 | U | 0.0017 | | 0.002 | | 0.0013 | U |
| Heptachlor Epoxide | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0014 | J | 0.0016 | J | 0.0013 | J | 0.0013 | U |
| trans-Chlordane | 0.0013 | U | 0.0012 | U | 0.0013 | U | 0.0014 | | 0.0026 | J | 0.00098 | J | 0.0013 | U |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | | | | | | | | | | | | | | |
| Total PCBs (Aroclors) | 0.0096 | U | 0.0095 | U | 0.0097 | U | 0.0094 | U | 0.11 | | 0.077 | | 0.0096 | U |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 0.96 | U |
| 2-Methylnaphthalene | 0.02 | J | 0.2 | U | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| 4-Methylphenol | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 0.49 | J | 0.96 | U |
| 4-Nitrophenol | 5 | U | 5 | U | 5 | U | 5.2 | U | 5.2 | U | 5 | | 4.8 | U |
| Acenaphthene | 0.2 | U | 0.2 | U | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| Acenaphthylene | 0.2 | U | 0.2 | U | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| Anthracene | 0.2 | U | 0.2 | U | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| Carbazole | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 0.96 | U |
| Dibenzofuran | 1 | U | 0.11 | J | 1 | U | 1 | U | 1 | U | 1 | U | 0.96 | U |
| Fluoranthene | 0.2 | U | 0.2 | U | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| Fluorene | 0.2 | U | 0.2 | U | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| Naphthalene | 0.27 | | 2.6 | | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| Pentachlorophenol | 0.53 | J | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 0.96 | U |
| Phenanthrene | 0.2 | U | 0.068 | J | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |
| Phenol | 0.26 | J | 1 | U | 1 | U | 1 | U | 0.12 | J | 0.22 | J | 0.96 | U |
| Pyrene | 0.2 | U | 0.2 | U | 0.2 | U | 0.21 | U | 0.21 | U | 0.2 | U | 0.19 | U |

Table 3
Evaluation of the Groundwater to Surface Water Migration Pathway
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | Nearshore Groundwater Wells - Lower Aquifer | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location ID | MW01 | | MW02 | | MW03 | | MW04 | | MW08 | | MW08 | | MW11 | |
| Sample ID | MW01BN | | MW02BN | | MW03BN | | MW04BN | | MW08BN | | MW08BR | | MW11BN | |
| Sample Date | 11/5/2014 | | 11/5/2014 | | 11/4/2014 | | 11/4/2014 | | 11/5/2014 | | 11/5/2014 | | 11/4/2014 | |
| **Chemical (d)** | | | | | | | | | | | | | | |
| **VOLATILE ORGANIC COMPOUNDS (VOCs)** | | | | | | | | | | | | | | |
| 2-Butanone | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| Acetone | 5 | U | 5 | U | 5 | U | 2.8 | J | 5 | U | 5 | | 5 | U |
| Benzene | 1 | U | 1 | U | 1 | U | 1 | U | 0.22 | J | 0.68 | J | 1 | U |
| Bromodichloromethane | 1 | U | 1 | U | 0.65 | J | 1 | U | 0.23 | J | 1 | U | 1 | U |
| Carbon Disulfide | 0.27 | J | 1 | U | 1.8 | | 1.1 | | 1 | U | 1 | U | 0.78 | J |
| Chloroform | 0.87 | J | 1 | U | 3.2 | | 1.4 | | 3.2 | | 2 | | 0.29 | J |
| cis-1,2-Dichloroethylene | 2.6 | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Dibromochloromethane | 1 | U | 1 | U | 0.24 | J | 1 | U | 1 | U | 1 | U | 1 | U |
| Methyl tert-Butyl Ether (MTBE) | 1 | | 0.39 | J | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Methylene Chloride | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 0.2 | J | 1 | U |
| Tetrachloroethylene | 110 | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| Toluene | 1 | U | 1 | U | 0.28 | J | 1 | U | 0.18 | J | 0.19 | J | 0.19 | J |
| Trichloroethene | 25 | | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |

Notes:
All units are in µg/L.
DAF - Dilution Attenuation Factor.
ESV - Ecological Screening Value.
J - Estimated value.
NA - Not analyzed.
NC - Not calculated.
NV - No Value.
TCDD TEQ - Dioxin Toxicity Equivalence.
U - Not detected above the laboratory reporting limit.
UJ - Not detected above laboratory reporting limit; Estimated value.
+/- Likely to have a high (+) or low (-) bias.
(a) Surface water concentrations were estimated by multiplying groundwater results from the nearshore monitoring wells by well-specific dilution attenuation factor (DAF). DAFs were derived separately for the upper and lower aquifers for each well.
(b) See Table 3-2 for specific source of screening level and surrogate used (if applicable).
(c) The flow-weighted average concentration is calculated using the following equation:

$$\frac{([CMW1A*QMW1A]+[CMW1B*QMW1B]+\ldots)+(CSWBCK*7Q10)}{(QMW1A+QMW1A+\ldots+7Q10)}$$

where:
CMW1A = Chemical concentration measured at monitoring well MW1A
QMW1A = Discharge rate calculated for monitoring well MW1A
CSWBCK= Average chemical concentration of upstream background surface water samples 1, 2, 3, 4, 5, and 6 (presented in Appendix J.
7Q10 = the lowest 7-day average flow that occurs on average once every 10 years
(d) Only chemicals detected at least once in nearshore groundwater monitoring wells are presented.

Table 3
Evaluation of the Groundwater to Surface Water Migration Pathway
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | Estimated Surface Water Concentrations Based on Well-Specific DAFs Applied to Measured Groundwater Data - Upper Aquifer (a) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location ID | | MW01 | | MW02 | | MW03 | | MW04 | | MW08 | | MW11 | |
| Sample ID | | MW01AN | | MW02AN | | MW03AN | | MW04AN | | MW08AN | | MW11AN | |
| Sample Date | Surface Water | 11/5/2014 | | 11/5/2014 | | 11/4/2014 | | 11/4/2014 | | 11/10/2014 | | 11/4/2014 | |
| | ESV (b) | DAF = 1.25E-04 | | DAF = 6.28E-05 | | DAF = 1.16E-05 | | DAF = 3.81E-06 | | DAF = 1.06E-04 | | DAF = 2.01E-04 | |
| Chemical (d) | | | | | | | | | | | | | |
| **DIOXIN TEQs** | | | | | | | | | | | | | |
| TCDD TEQ Fish | 1.00E-05 | 3.45E-12 | | NC | | 1.45E-14 | | 4.58E-14 | | NC | | 8.49E-06 | |
| **INORGANICS - DISSOLVED PHASE** | | | | | | | | | | | | | |
| Arsenic | 150 | 0.00013 | U | 0.00014 | | 0.00001 | | 0.000004 | U | 0.00013 | | 0.00020 | U |
| Barium | 4 | 0.02253 | | 0.00100 | | 0.00107 | | 0.00033 | | 0.00613 | | 0.00763 | |
| Beryllium | 0.66 | 0.00013 | UJ | 0.00006 | U | 0.00001 | U | 0.000004 | UJ | 0.00011 | U | 0.00020 | U |
| Calcium | 116000 | 9.0 | | 3.1 | | 0.4 | | 0.2 | | 4.0 | | 4.0 | |
| Cobalt | 23 | 0.00106 | | 0.00003 | U | 0.00007 | | 0.00011 | | 0.00056 | | 0.00044 | |
| Iron | 1000 | 0.0063 | U | 0.0031 | U | 0.0006 | U | 0.0002 | U | 0.0053 | U | 0.0100 | U |
| Magnesium | 82000 | 1.38 | | 0.31 | | 0.05 | | 0.06 | | 0.77 | | 0.82 | |
| Manganese | 120 | 0.48 | | 0.01256 | | 0.04 | | 0.02 | | 0.14 | | 0.09 | |
| Nickel | 33.8 | 0.00004 | J- | 0.00003 | J | 0.00003 | | 0.00002 | | 0.00021 | | 0.00022 | |
| Potassium | 53000 | 0.78 | | 0.46 | | 0.07 | | 0.03 | | 0.63 | | 0.80 | |
| Sodium | 680000 | 12.5 | | 6.0 | | 0.5 | | 0.6 | | 2.7 | | 2.8 | |
| Thallium | NV | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.00000 | U | 0.000005 | J | 0.00020 | U |
| Vanadium | 20 | 0.00059 | J+ | 0.00041 | J+ | 0.00005 | J+ | 0.00001 | J | 0.00043 | J+ | 0.00116 | J+ |
| Zinc | 76.6 | 0.00063 | U | 0.00031 | U | 0.00006 | U | 0.00002 | U | 0.00053 | U | 0.00100 | U |
| **INORGANICS - TOTAL RECOVERABLE PHASE** | | | | | | | | | | | | | |
| Thallium | 0.8 | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.00000 | U | 0.00000 | J | 0.00020 | U |
| **PESTICIDES** | | | | | | | | | | | | | |
| 4,4'-DDE | 0.001 | 1.50E-07 | U | 8.16E-08 | U | 1.39E-08 | U | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| 4,4'-DDT | 0.001 | 1.50E-07 | U | 8.16E-08 | U | 1.39E-08 | U | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| beta-BHC | 2.2 | 1.50E-07 | U | 8.16E-08 | U | 1.10E-08 | J | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| delta-BHC | 141 | 1.50E-07 | U | 2.51E-08 | J | 1.39E-08 | U | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| Endosulfan Sulfate | 0.056 | 1.50E-07 | U | 8.16E-08 | U | 1.39E-08 | U | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| Endrin | 0.036 | 1.50E-07 | U | 8.16E-08 | U | 1.39E-08 | U | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| Heptachlor Epoxide | 0.0038 | 1.50E-07 | U | 8.16E-08 | U | 1.39E-08 | U | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| trans-Chlordane | 0.0022 | 1.50E-07 | U | 8.16E-08 | U | 1.39E-08 | U | 4.96E-09 | U | 1.37E-07 | U | 2.41E-07 | U |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | | | | | | | | | | | | | |
| Total PCBs (Aroclors) | 0.014 | 1.19E-06 | U | 6.03E-07 | U | 1.10E-07 | U | 3.74E-08 | U | 1.03E-06 | U | 1.91E-06 | U |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 14 | 0.00013 | U | 0.00002 | J | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| 2-Methylnaphthalene | 4.7 | 0.00000 | J | 0.00008 | | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |
| 4-Methylphenol | 543 | 0.00004 | J | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| 4-Nitrophenol | 60 | 0.00063 | U | 0.00030 | U | 0.00006 | U | 0.00002 | U | 0.00053 | U | 0.00100 | U |
| Acenaphthene | 50 | 0.00003 | U | 0.00008 | | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |
| Acenaphthylene | 4840 | 0.00003 | U | 0.00001 | J | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |
| Anthracene | 0.012 | 0.00003 | U | 0.000003 | J | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |
| Carbazole | NV | 0.00013 | U | 0.00002 | J | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Dibenzofuran | 3.7 | 0.00013 | U | 0.00004 | J | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Fluoranthene | 400 | 0.00003 | U | 0.00001 | J | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |
| Fluorene | 3 | 0.00003 | U | 0.00004 | | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |
| Naphthalene | 600 | 0.00003 | | 0.00082 | J | 0.000002 | U | 0.000001 | U | 0.00000 | J | 0.00004 | U |
| Pentachlorophenol | 5.10 | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Phenanthrene | 0.4 | 0.00003 | U | 0.00004 | | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |
| Phenol | 4 | 0.00007 | J | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Pyrene | 0.025 | 0.00003 | U | 0.000003 | J | 0.000002 | U | 0.000001 | U | 0.00002 | U | 0.00004 | U |

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**Table 3**
**Evaluation of the Groundwater to Surface Water Migration Pathway**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | **Estimated Surface Water Concentrations Based on Well-Specific DAFs Applied to Measured Groundwater Data - Upper Aquifer (a)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location ID** | | **MW01** | | **MW02** | | **MW03** | | **MW04** | | **MW08** | | **MW11** | |
| **Sample ID** | | **MW01AN** | | **MW02AN** | | **MW03AN** | | **MW04AN** | | **MW08AN** | | **MW11AN** | |
| **Sample Date** | **Surface Water** | **11/5/2014** | | **11/5/2014** | | **11/4/2014** | | **11/4/2014** | | **11/10/2014** | | **11/4/2014** | |
| | **ESV (b)** | DAF = 1.25E-04 | | DAF = 6.28E-05 | | DAF = 1.16E-05 | | DAF = 3.81E-06 | | DAF = 1.06E-04 | | DAF = 2.01E-04 | |
| **Chemical (d)** | | | | | | | | | | | | | |
| **VOLATILE ORGANIC COMPOUNDS (VOCs)** | | | | | | | | | | | | | |
| 2-Butanone | 14000 | 0.00063 | U | 0.00031 | U | 0.00009 | | 0.00002 | U | 0.00053 | U | 0.00100 | U |
| Acetone | 1500 | 0.00063 | U | 0.00031 | U | 0.00005 | J | 0.00002 | U | 0.00053 | U | 0.00100 | U |
| Benzene | 1000 | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.00000 | U | 0.00011 | U | 0.00020 | U |
| Bromodichloromethane | NV | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Carbon Disulfide | 0.92 | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | |
| Chloroform | 3000 | 0.00013 | U | 0.00006 | U | 0.00001 | | 0.000001 | J | 0.00013 | | 0.00020 | U |
| cis-1,2-Dichloroethylene | NV | 0.00012 | J | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Dibromochloromethane | NV | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Methyl tert-Butyl Ether (MTBE) | 11070 | 0.00020 | | 0.00006 | U | 0.00001 | U | 0.000001 | J | 0.00011 | U | 0.00020 | U |
| Methylene Chloride | NV | 0.00013 | U | 0.00006 | U | 0.00001 | U | 0.00000 | U | 0.00011 | U | 0.00020 | U |
| Tetrachloroethylene | 800 | 0.00055 | | 0.00014 | | 0.000004 | J | 0.000001 | J | 0.00011 | U | 0.00004 | J |
| Toluene | 600 | 0.00013 | U | 0.00006 | U | 0.000004 | J | 0.000004 | U | 0.00011 | U | 0.00020 | U |
| Trichloroethene | 21 | 0.00005 | J | 0.00006 | U | 0.00001 | U | 0.000004 | U | 0.00011 | U | 0.00020 | U |

Notes:
All units are in µg/L.
DAF - Dilution Attenuation Factor.
ESV - Ecological Screening Value.
J - Estimated value.
NA - Not analyzed.
NC - Not calculated.
NV - No Value.
TCDD TEQ - Dioxin Toxicity Equivalence.
U - Not detected above the laboratory reporting limit.
UJ - Not detected above laboratory reporting limit; Estimated value.
+/- Likely to have a high (+) or low (-) bias.
(a) Surface water concentrations were estimated by multiplying groundwater results from the nearshore monitoring wells by well-specific dilution attenuation factor (DAF). DAFs were derived separately for the upper and lower aquifers for each well.
(b) See Table 3-2 for specific source of screening level and surrogate used (if applicable).
(c) The flow-weighted average concentration is calculated using the following equation:

$$\frac{([CMW1A*QMW1A]+[CMW1B*QMW1B]+\ldots)+(CSWBCK*7Q10)}{(QMW1A+QMW1A+\ldots+7Q10)}$$

where:
CMW1A = Chemical concentration measured at monitoring well MW1A
QMW1A = Discharge rate calculated for monitoring well MW1A
CSWBCK= Average chemical concentration of upstream background surface water samples 1, 2, 3, 4, 5, and 6 (presented in Appendix J.
7Q10 = the lowest 7-day average flow that occurs on average once every 10 years
(d) Only chemicals detected at least once in nearshore groundwater monitoring wells are presented.

Table 3
Evaluation of the Groundwater to Surface Water Migration Pathway
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | Estimated Surface Water Concentrations Based on Well-Specific DAFs Applied to Measured Groundwater Data - Lower Aquifer (a) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location ID | | MW01 | | MW02 | | MW03 | | MW04 | | MW08 | | MW08 | | MW11 | |
| Sample ID | | MW01BN | | MW02BN | | MW03BN | | MW04BN | | MW08BN | | MW08BR | | MW11BN | |
| Sample Date | Surface Water | 11/5/2014 | | 11/5/2014 | | 11/4/2014 | | 11/4/2014 | | 11/5/2014 | | 11/5/2014 | | 11/4/2014 | |
| | ESV (b) | DAF = 5.08E-05 | | DAF = 1.09E-04 | | DAF = 8.56E-05 | | DAF = 4.16E-05 | | DAF = 1.63E-04 | | DAF = 1.63E-04 | | DAF = 1.21E-04 | |
| **Chemical (d)** | | | | | | | | | | | | | | | |
| **DIOXIN TEQs** | | | | | | | | | | | | | | | |
| TCDD TEQ Fish | 0.00001 | 1.20E-13 | | NC | | 2.42E-13 | | 1.05E-10 | U | NC | | NC | | **0.00003** | |
| **INORGANICS - DISSOLVED PHASE** | | | | | | | | | | | | | | | |
| Arsenic | 150 | 0.00005 | U | 0.00011 | U | 0.00004 | J | 0.00004 | J | 0.00005 | J | 0.00016 | U | 0.00027 | |
| Barium | 4 | 0.00965 | | 0.00815 | | 0.01284 | | 0.00416 | | 0.02286 | | 0.02123 | | 0.01450 | |
| Beryllium | 0.66 | 0.00005 | UJ | 0.00006 | J | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Calcium | 116000 | 1.5 | | 1.3 | | 1.7 | | 1.0 | | 2.8 | | 2.6 | | 3.5 | |
| Cobalt | 23 | 0.00042 | | 0.00282 | | 0.00016 | | 0.00008 | | 0.00014 | | 0.00012 | | 0.00002 | J |
| Iron | 1000 | 0.29 | J | 3.26 | J | 0.01627 | J | 0.02370 | J | 0.00817 | U | 0.00817 | U | 0.00604 | |
| Magnesium | 82000 | 0.66 | | 0.52 | | 0.52 | | 0.33 | | 1.05 | | 0.93 | | 0.82 | |
| Manganese | 120 | 0.17 | | 0.17 | | 0.05 | | 0.040 | | 0.046 | | 0.041 | | 0.044 | |
| Nickel | 33.8 | 0.00022 | J- | 0.00119 | | 0.00010 | | 0.00007 | | 0.00014 | J | 0.00011 | J | 0.00004 | J |
| Potassium | 53000 | 0.25 | | 0.26 | | 0.23 | | 0.15 | | 0.64 | | 0.57 | | 1.17 | |
| Sodium | 680000 | 6.1 | | 3.9 | | 1.1 | | 0.7 | | 3.1 | | 2.8 | | 5.6 | |
| Thallium | NV | 0.00005 | U | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Vanadium | 20 | 0.00016 | J | 0.00038 | J+ | 0.00021 | J+ | 0.00006 | J+ | 0.00016 | U | 0.00069 | J+ | 0.00046 | J+ |
| Zinc | 76.6 | 0.00027 | U | 0.00424 | | 0.00064 | U | 0.00021 | U | 0.00082 | U | 0.00082 | U | 0.00060 | U |
| **INORGANICS - TOTAL RECOVERABLE PHASE** | | | | | | | | | | | | | | | |
| Thallium | 0.8 | 0.00005 | U | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| **PESTICIDES** | | | | | | | | | | | | | | | |
| 4,4'-DDE | 0.001 | 6.60E-08 | U | 1.30E-07 | U | 1.11E-07 | U | 4.99E-08 | U | 2.12E-07 | U | 1.63E-07 | J | 1.57E-07 | U |
| 4,4'-DDT | 0.001 | 6.60E-08 | U | 1.30E-07 | U | 1.11E-07 | U | 4.99E-08 | U | 6.86E-07 | | 6.04E-07 | | 3.38E-07 | |
| beta-BHC | 2.2 | 6.60E-08 | U | 1.19E-07 | J | 1.11E-07 | U | 4.99E-08 | U | 2.12E-07 | U | 2.12E-07 | U | 1.57E-07 | U |
| delta-BHC | 141 | 6.60E-08 | U | 1.30E-07 | U | 1.11E-07 | U | 4.99E-08 | U | 2.12E-07 | U | 2.12E-07 | U | 1.57E-07 | U |
| Endosulfan Sulfate | 0.056 | 6.60E-08 | U | 1.30E-07 | U | 1.11E-07 | U | 3.04E-08 | J | 2.12E-07 | U | 2.12E-07 | U | 1.57E-07 | U |
| Endrin | 0.036 | 6.60E-08 | U | 1.30E-07 | U | 1.11E-07 | U | 4.99E-08 | U | 2.78E-07 | | 3.27E-07 | | 1.57E-07 | U |
| Heptachlor Epoxide | 0.0038 | 6.60E-08 | U | 1.30E-07 | U | 1.11E-07 | U | 5.82E-08 | J | 2.61E-07 | J | 2.12E-07 | J | 1.57E-07 | U |
| trans-Chlordane | 0.0022 | 6.60E-08 | U | 1.30E-07 | U | 1.11E-07 | U | 5.82E-08 | | 4.25E-07 | J | 1.60E-07 | J | 1.57E-07 | U |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | | | | | | | | | | | | | | | |
| Total PCBs (Aroclors) | 0.014 | 4.88E-07 | U | 1.03E-06 | U | 8.30E-07 | U | 3.91E-07 | U | 1.80E-05 | | 1.26E-05 | | 1.16E-06 | U |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | | | | | | | |
| 1,1'-Biphenyl | 14 | 0.00005 | U | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| 2-Methylnaphthalene | 4.7 | 0.000001 | J | 0.00002 | U | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| 4-Methylphenol | 543 | 0.00005 | U | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00008 | J | 0.00012 | U |
| 4-Nitrophenol | 60 | 0.00025 | U | 0.00054 | U | 0.00043 | U | 0.00022 | U | 0.00085 | U | 0.00082 | U | 0.00058 | U |
| Acenaphthene | 50 | 0.00001 | U | 0.00002 | U | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| Acenaphthylene | 4840 | 0.00001 | U | 0.00002 | U | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| Anthracene | 0.012 | 0.00001 | U | 0.00002 | U | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| Carbazole | NV | 0.00005 | U | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Dibenzofuran | 3.7 | 0.00005 | U | 0.00001 | J | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Fluoranthene | 400 | 0.00001 | U | 0.00002 | U | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| Fluorene | 3 | 0.00001 | U | 0.00002 | U | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| Naphthalene | 600 | 0.00001 | | 0.00028 | | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| Pentachlorophenol | 5.10 | 0.00003 | J | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Phenanthrene | 0.4 | 0.00001 | U | 0.00001 | J | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |
| Phenol | 4 | 0.00001 | J | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00002 | J | 0.00004 | J | 0.00012 | U |
| Pyrene | 0.025 | 0.00001 | U | 0.00002 | U | 0.00002 | U | 0.00001 | U | 0.00003 | U | 0.00003 | U | 0.00002 | U |

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**Table 3**
**Evaluation of the Groundwater to Surface Water Migration Pathway**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | Estimated Surface Water Concentrations Based on Well-Specific DAFs Applied to Measured Groundwater Data - Lower Aquifer (a) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location ID** | | **MW01** | | **MW02** | | **MW03** | | **MW04** | | **MW08** | | **MW08** | | **MW11** | |
| **Sample ID** | | **MW01BN** | | **MW02BN** | | **MW03BN** | | **MW04BN** | | **MW08BN** | | **MW08BR** | | **MW11BN** | |
| **Sample Date** | **Surface Water** | **11/5/2014** | | **11/5/2014** | | **11/4/2014** | | **11/4/2014** | | **11/5/2014** | | **11/5/2014** | | **11/4/2014** | |
| | **ESV (b)** | DAF = 5.08E-05 | | DAF = 1.09E-04 | | DAF = 8.56E-05 | | DAF = 4.16E-05 | | DAF = 1.63E-04 | | DAF = 1.63E-04 | | DAF = 1.21E-04 | |
| **Chemical (d)** | | | | | | | | | | | | | | | |
| **VOLATILE ORGANIC COMPOUNDS (VOCs)** | | | | | | | | | | | | | | | |
| 2-Butanone | 14000 | 0.00025 | U | 0.00054 | U | 0.00043 | U | 0.00021 | U | 0.00082 | U | 0.00082 | U | 0.00060 | U |
| Acetone | 1500 | 0.00025 | U | 0.00054 | U | 0.00043 | U | 0.00012 | J | 0.00082 | U | 0.00082 | | 0.00060 | U |
| Benzene | 1000 | 0.00005 | U | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00004 | J | 0.00011 | J | 0.00012 | U |
| Bromodichloromethane | NV | 0.00005 | U | 0.00011 | U | 0.00006 | J | 0.00004 | U | 0.00004 | J | 0.00016 | U | 0.00012 | U |
| Carbon Disulfide | 0.92 | 0.00001 | J | 0.00011 | U | 0.00015 | | 0.00005 | | 0.00016 | U | 0.00016 | U | 0.00009 | J |
| Chloroform | 3000 | 0.00004 | J | 0.00011 | U | 0.00027 | | 0.00006 | | 0.00052 | | 0.00033 | | 0.00004 | J |
| cis-1,2-Dichloroethylene | NV | 0.00013 | | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Dibromochloromethane | NV | 0.00005 | U | 0.00011 | U | 0.00002 | J | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Methyl tert-Butyl Ether (MTBE) | 11070 | 0.00005 | | 0.00004 | J | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Methylene Chloride | NV | 0.00005 | U | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00003 | J | 0.00012 | U |
| Tetrachloroethylene | 800 | 0.00559 | | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |
| Toluene | 600 | 0.00005 | U | 0.00011 | U | 0.00002 | J | 0.00004 | U | 0.00003 | J | 0.00003 | J | 0.00002 | J |
| Trichloroethene | 21 | 0.00127 | | 0.00011 | U | 0.00009 | U | 0.00004 | U | 0.00016 | U | 0.00016 | U | 0.00012 | U |

Notes:
All units are in μg/L.
DAF - Dilution Attenuation Factor.
ESV - Ecological Screening Value.
J - Estimated value.
NA - Not analyzed.
NC - Not calculated.
NV - No Value.
TCDD TEQ - Dioxin Toxicity Equivalence.
U - Not detected above the laboratory reporting limit.
UJ - Not detected above laboratory reporting limit; Estimated value.
+/- Likely to have a high (+) or low (-) bias.
(a) Surface water concentrations were estimated by multiplying groundwater results from the nearshore monitoring wells by well-specific dilution attenuation factor (DAF). DAFs were derived separately for the upper and lower aquifers for each well.
(b) See Table 3-2 for specific source of screening level and surrogate used (if applicable).
(c) The flow-weighted average concentration is calculated using the following equation:

$$\frac{([CMW1A*QMW1A]+[CMW1B*QMW1B]+\ldots)+(CSWBCK*7Q10)}{(QMW1A+QMW1A+\ldots+7Q10)}$$

where:
CMW1A = Chemical concentration measured at monitoring well MW1A
QMW1A = Discharge rate calculated for monitoring well MW1A
CSWBCK= Average chemical concentration of upstream background surface water samples 1, 2, 3, 4, 5, and 6 (presented in Appendix J.
7Q10 = the lowest 7-day average flow that occurs on average once every 10 years
(d) Only chemicals detected at least once in nearshore groundwater monitoring wells are presented.

Table 3
Evaluation of the Groundwater to Surface Water Migration Pathway
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| Location ID<br>Sample ID<br>Sample Date | Flow-weighted Average Concentration (c) |
|---|---|
| **Chemical (d)** | |
| **DIOXIN TEQs** | |
| TCDD TEQ Fish | 2.86E-06 |
| **INORGANICS - DISSOLVED PHASE** | |
| Arsenic | 0.04 |
| Barium | 2.82 |
| Beryllium | 0.000074 |
| Calcium | 1464 |
| Cobalt | 0.01 |
| Iron | 0.92 |
| Magnesium | 459 |
| Manganese | 0.09 |
| Nickel | 0.13 |
| Potassium | 271 |
| Sodium | 1908 |
| Thallium | 0.00171 |
| Vanadium | 0.010 |
| Zinc | 0.39 |
| **INORGANICS - TOTAL RECOVERABLE PHASE** | |
| Thallium | 0.001876 |
| **PESTICIDES** | |
| 4,4'-DDE | 9.57E-08 |
| 4,4'-DDT | 7.24E-05 |
| beta-BHC | 9.65E-08 |
| delta-BHC | 9.34E-08 |
| Endosulfan Sulfate | 9.60E-08 |
| Endrin | 1.04E-07 |
| Heptachlor Epoxide | 9.98E-08 |
| trans-Chlordane | 1.04E-07 |
| **POLYCHLORINATED BIPHENYLs (PCBs)** | |
| Total PCBs (Aroclors) | 1.73E-06 |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | |
| 1,1'-Biphenyl | 0.00007 |
| 2-Methylnaphthalene | 0.00002 |
| 4-Methylphenol | 0.00007 |
| 4-Nitrophenol | 0.00039 |
| Acenaphthene | 0.00002 |
| Acenaphthylene | 0.00002 |
| Anthracene | 0.00001 |
| Carbazole | 0.00007 |
| Dibenzofuran | 0.00007 |
| Fluoranthene | 0.0020 |
| Fluorene | 0.00002 |
| Naphthalene | 0.0019 |
| Pentachlorophenol | 0.00008 |
| Phenanthrene | 0.00347 |
| Phenol | 0.00006 |
| Pyrene | 0.00155 |

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**Table 3**
**Evaluation of the Groundwater to Surface Water Migration Pathway**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| Location ID<br>Sample ID<br>Sample Date | Flow-weighted Average Concentration (c) |
|---|---|
| **Chemical (d)** | |
| **VOLATILE ORGANIC COMPOUNDS (VOCs)** | |
| 2-Butanone | 0.00039 |
| Acetone | 0.24 |
| Benzene | 0.00007 |
| Bromodichloromethane | 0.00007 |
| Carbon Disulfide | 0.00008 |
| Chloroform | 0.00011 |
| cis-1,2-Dichloroethylene | 0.00008 |
| Dibromochloromethane | 0.00007 |
| Methyl tert-Butyl Ether (MTBE) | 0.00008 |
| Methylene Chloride | 0.00007 |
| Tetrachloroethylene | 0.00050 |
| Toluene | 0.02162 |
| Trichloroethene | 0.00016 |

Notes:
All units are in µg/L.
DAF - Dilution Attenuation Factor.
ESV - Ecological Screening Value.
J - Estimated value.
NA - Not analyzed.
NC - Not calculated.
NV - No Value.
TCDD TEQ - Dioxin Toxicity Equivalence.
U - Not detected above the laboratory reporting limit.
UJ - Not detected above laboratory reporting limit; Estimated value.
+/- Likely to have a high (+) or low (-) bias.
(a) Surface water concentrations were estimated by multiplying groundwater results from the nearshore monitoring wells by well-specific dilution attenuation factor (DAF). DAFs were derived separately for the upper and lower aquifers for each well.
(b) See Table 3-2 for specific source of screening level and surrogate used (if applicable).
(c) The flow-weighted average concentration is calculated using the following equation:

$$\frac{([CMW1A*QMW1A]+[CMW1B*QMW1B]+\ldots)+(CSWBCK*7Q10)}{(QMW1A+QMW1A+\ldots+7Q10)}$$

where:

CMW1A = Chemical concentration measured at monitoring well MW1A
QMW1A = Discharge rate calculated for monitoring well MW1A
CSWBCK= Average chemical concentration of upstream background surface water samples 1, 2, 3, 4, 5, and 6 (presented in Appendix J.
7Q10 = the lowest 7-day average flow that occurs on average once every 10 years
(d) Only chemicals detected at least once in nearshore groundwater monitoring wells are presented.

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**Table 4**
**Ecological Screen of Surface Water Samples Collected at Background Locations**
**Benning Road Facility RI/FS Project**
**3400 Benning Rd, N.E., Washington DC 20019**

| | | **Sample Location** | SUWBACK1 | SUWBACK2 | SUWBACK3 | SUWBACK4 | SUWBACK5 | SUWBACK6 | SUWBACK11 |
|---|---|---|---|---|---|---|---|---|---|
| **Detected Analyte** | **Chronic ESV (a)** | **Acute ESV (b)** | | | | | | | |
| **INORGANICS - DISSOLVED** | | | | | | | | | |
| Barium | 4 | 110 | 43 | 58 | 39 | 33 | 31 | 31 | 38 |
| **PESTICIDES** | | | | | | | | | |
| 4,4'-DDT | 0.001 | 1.1 | 0.0013 U | 0.0013 U | | 0.0012 | 0.00081 J | | |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | | |
| Anthracene | 0.012 | 13 | 0.21 U | 0.2 U | 0.19 U | 0.19 U | 0.19 U | 0.19 U | 0.2 U |
| Pyrene | 0.025 | NV | 0.21 U | 0.2 U | 0.022 J | 0.023 J | 0.19 U | 0.019 J | 0.2 U |

Notes:
All values reported in micrograms per liter (ug/L).
Green highlighted cells indicate concentrations that are greater than the Chronic ESV.
Blue highlighted cells indicate concentrations that are greater than the Acute ESV.
EN - Essential Nutrient.
ESL - Ecological Screening Level.
ESV - Ecological Screening Value.
J = The chemical was positively identified; however, the associated numerical value is an estimated concentration only.
NV - No Value.
U - The chemical was not detected.
SAV - Secondary Acute Value.
(a) Chronic ESVs selected based on a hierarchy of chronic water quality standards and benchmarks from DDOE WQS (DOH, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and other literature values (Suter and Tsao 1996, Buchman 2008).
(b) Acute ESVs selected based on freshwater acute criteria available from DDOE (DOH, 2010), Buchman (2008), and Suter and Tsao (1996; SAV).

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# Table 4
## Ecological Screen of Surface Water Samples Collected at Background Locations
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | Sample Location | SUWBACK12 | | SUWBACK13 | | SUWBACK15 | |
|---|---|---|---|---|---|---|---|---|
| **Detected Analyte** | **Chronic ESV (a)** | **Acute ESV (b)** | | | | | | |
| **INORGANICS - DISSOLVED** | | | | | | | | |
| Barium | 4 | 110 | 38 | | 40 | | 40 | |
| **PESTICIDES** | | | | | | | | |
| 4,4'-DDT | 0.001 | 1.1 | 0.0011 | J | | | 0.0012 | J |
| **SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)** | | | | | | | | |
| Anthracene | 0.012 | 13 | 0.21 | U | 0.19 | U | 0.22 | U |
| Pyrene | 0.025 | NV | 0.21 | U | 0.02 | J | 0.22 | U |

Notes:
All values reported in micrograms per liter (ug/L).
Green highlighted cells indicate concentrations that are greater than the Chronic E
Blue highlighted cells indicate concentrations that are greater than the Acute ESV.
EN - Essential Nutrient.
ESL - Ecological Screening Level.
ESV - Ecological Screening Value.
J = The chemical was positively identified; however, the associated numerical value is an estimated concentration only.
NV - No Value.
U - The chemical was not detected.
SAV - Secondary Acute Value.
(a) Chronic ESVs selected based on a hierarchy of chronic water quality standards and benchmarks from DDOE WQS (DOH, 2010), USEPA Region 3 freshwater surface water screening values (USEPA 2006b), and other literature values (Suter and Tsao 1996, Buchman 2008).
(b) Acute ESVs selected based on freshwater acute criteria available from DDOE (DOH, 2010), Buchman (2008), and Suter and Tsao (1996; SAV).

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# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK1 | | SUWBACK11 | | SUWBACK12 | | SUWBACK13 | | SUWBACK15 | |
| | | | | | sys_sample_code | SUWBACK1N | | SUWBACK11N | | SUWBACK12N | | SUWBACK13N | | SUWBACK15N | |
| | | | | | sample_date | 10/3/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 6.1 | | 1.8 | | 11.9 | | 5.15 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDD | 35822-46-9 | SW8290A | N | ug/l | 7.84E-07 | U | | | 6.46E-06 | J | | | 6.97E-06 | J |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDF | 67562-39-4 | SW8290A | N | ug/l | 6.68E-07 | J | | | 1.09E-06 | J | | | 1.06E-06 | J |
| RA_SW_DioxinFurans | 1,2,3,4,7,8,9-HpCDF | 55673-89-7 | SW8290A | N | ug/l | 6.86E-08 | U | | | 7.79E-08 | U | | | 8.68E-08 | U |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDD | 39227-28-6 | SW8290A | N | ug/l | 4.87E-08 | U | | | 7.07E-08 | U | | | 1.07E-07 | U |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDF | 70648-26-9 | SW8290A | N | ug/l | 3E-07 | J | | | 8.16E-08 | U | | | 8.15E-08 | U |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDD | 57653-85-7 | SW8290A | N | ug/l | 5.28E-08 | U | | | 7.44E-08 | U | | | 1.1E-07 | U |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDF | 57117-44-9 | SW8290A | N | ug/l | 6.57E-08 | U | | | 8.86E-08 | U | | | 4.98E-07 | J |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDD | 19408-74-3 | SW8290A | N | ug/l | 3.46E-07 | J | | | 6.57E-08 | U | | | 9.81E-08 | U |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDF | 72918-21-9 | SW8290A | N | ug/l | 7.52E-08 | U | | | 9.96E-08 | U | | | 9.33E-08 | U |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDD | 40321-76-4 | SW8290A | N | ug/l | 3.5E-08 | U | | | 5.73E-08 | U | | | 5.12E-08 | U |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDF | 57117-41-6 | SW8290A | N | ug/l | 6.55E-08 | U | | | 9.26E-08 | U | | | 9.13E-08 | U |
| RA_SW_DioxinFurans | 2,3,4,6,7,8-HxCDF | 60851-34-5 | SW8290A | N | ug/l | 5.37E-08 | U | | | 7.79E-08 | U | | | 7.35E-08 | U |
| RA_SW_DioxinFurans | 2,3,4,7,8-PeCDF | 57117-31-4 | SW8290A | N | ug/l | 7.21E-07 | J | | | 8.65E-08 | U | | | 6.35E-07 | J |
| RA_SW_DioxinFurans | 2,3,7,8-TCDD | 1746-01-6 | SW8290A | N | ug/l | 2.21E-07 | J | | | 7.43E-08 | U | | | 5.28E-08 | U |
| RA_SW_DioxinFurans | 2,3,7,8-TCDF | 51207-31-9 | SW8290A | N | ug/l | 2.49E-08 | U | | | 1.13E-07 | U | | | 7.85E-08 | U |
| RA_SW_DioxinFurans | OCDD | 3268-87-9 | SW8290A | N | ug/l | 1.4E-05 | U | | | 0.000194 | | | | 0.000202 | |
| RA_SW_DioxinFurans | OCDF | 39001-02-0 | SW8290A | N | ug/l | 1.35E-06 | J | | | 2.43E-06 | J | | | 1.41E-06 | J |
| RA_SW_DioxinFurans | TCDD TEQ Bird | DFTEQ-Bird | SW8290A | N | ug/l | 1.01E-06 | | | | 3.7E-08 | | | | 7.23E-07 | |
| RA_SW_DioxinFurans | TCDD TEQ Fish | DFTEQ-Fish | SW8290A | N | ug/l | 6.22E-07 | | | | 3.7E-08 | | | | 4.05E-07 | |
| RA_SW_DioxinFurans | TCDD TEQ HH | DFTEQ-HH | SW8290A | N | ug/l | 5.09E-07 | | | | 1.34E-07 | | | | 3.82E-07 | |
| RA_SW_DioxinFurans | Total HpCDD | 37871-00-4 | SW8290A | N | ug/l | 1.97E-06 | J | | | 1.43E-05 | J | | | 1.64E-05 | J |
| RA_SW_DioxinFurans | Total HpCDF | 38998-75-3 | SW8290A | N | ug/l | 6.68E-07 | J | | | 2.88E-06 | J | | | 2.39E-06 | J |
| RA_SW_DioxinFurans | Total HxCDD | 34465-46-8 | SW8290A | N | ug/l | 3.46E-07 | U | | | 1.93E-06 | J | | | 3.55E-06 | J |
| RA_SW_DioxinFurans | Total HxCDF | 55684-94-1 | SW8290A | N | ug/l | 4.79E-07 | U | | | 5.56E-06 | J | | | 6.45E-06 | J |
| RA_SW_DioxinFurans | Total PeCDD | 36088-22-9 | SW8290A | N | ug/l | 6.91E-07 | J | | | 5.73E-08 | U | | | 4.25E-07 | J |
| RA_SW_DioxinFurans | Total PeCDF | 30402-15-4 | SW8290A | N | ug/l | 1.21E-06 | U | | | 7.47E-06 | J | | | 1.11E-05 | J |
| RA_SW_DioxinFurans | Total TCDD | 41903-57-5 | SW8290A | N | ug/l | 3.12E-07 | J | | | 4.6E-07 | J | | | 5.28E-08 | U |
| RA_SW_DioxinFurans | Total TCDF | 55722-27-5 | SW8290A | N | ug/l | 2.45E-07 | J | | | 1.23E-05 | J | | | 1.42E-05 | J |
| RA_SW_DioxinFurans | Total TEQ | TTEQ | SW8290A | N | ug/l | 5.09E-07 | | | | 1.34E-07 | | | | 3.82E-07 | |
| RA_SW_Field | Conductivity | Cond | FIELD | T | ms/cm | 0.376 | | 0.255 | | 0.287 | | 0.289 | | 0.299 | |
| RA_SW_Field | DO | DO | FIELD | T | mg/l | 8.23 | | 4.44 | | 3.71 | | 3.62 | | 3.58 | |
| RA_SW_Field | OXIDATION-REDUCTION POTENTIAL | ORP | FIELD | T | mV | 4.9 | | 83.8 | | 53 | | 72.6 | | 104.9 | |
| RA_SW_Field | PH | PH | FIELD | T | ph units | 7.43 | | 6.44 | | 6.7 | | 6.66 | | 6.8 | |
| RA_SW_Field | SALINITY | SAL | FIELD | T | ppt | 0.18 | | 0.12 | | 0.14 | | 0.14 | | 0.14 | |
| RA_SW_Field | TEMPERATURE | TEMP | FIELD | T | deg F | 64.72 | | 66.18 | | 68.13 | | 68.07 | | 67.41 | |
| RA_SW_Field | TURBIDITY | TURB | FIELD | T | ntu | 1.3 | | 11.2 | | 0 | | 5.5 | | 3.6 | |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | D | ug/l | 30 | U | 30 | U | 30 | U | 30 | U | 30 | U |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | T | ug/l | 26 | J | 610 | | 350 | | 390 | | 320 | |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | D | ug/l | 0.19 | J | 1.1 | J | 1.1 | J | 0.76 | J | 0.75 | J |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | T | ug/l | 0.17 | J | 0.56 | J | 0.55 | J | 0.55 | J | 0.53 | J |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | D | ug/l | 1 | U | 0.48 | J | 0.55 | J | 0.65 | J | 1 | U |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | T | ug/l | 2.1 | | 0.95 | J | 0.77 | J | 0.92 | J | 1.1 | J |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | D | ug/l | 43 | | 38 | | 38 | | 40 | | 40 | |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK1 | | SUWBACK11 | | SUWBACK12 | | SUWBACK13 | | SUWBACK15 | |
| | | | | | sys_sample_code | SUWBACK1N | | SUWBACK11N | | SUWBACK12N | | SUWBACK13N | | SUWBACK15N | |
| | | | | | sample_date | 10/3/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 6.1 | | 1.8 | | 11.9 | | 5.15 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | T | ug/l | 45 | | 46 | | 44 | | 43 | | 44 | |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | T | ug/l | 0.05 | J | 0.099 | J | 0.044 | J | 0.077 | J | 0.057 | J |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | D | ug/l | 19000 | | 18000 | | 20000 | | 21000 | | 22000 | |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | T | ug/l | 21000 | | 18000 | | 21000 | | 20000 | | 21000 | |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | D | ug/l | 1.9 | J | 1.9 | J | 2.2 | | 1.9 | J | 1.7 | J |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | T | ug/l | 1.1 | J | 3.3 | | 2.6 | | 2.8 | | 2.5 | |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | D | ug/l | 0.16 | J | 0.21 | J | 0.13 | J | 0.14 | J | 0.15 | J |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | T | ug/l | 0.52 | | 1.3 | | 0.88 | | 0.93 | | 0.8 | |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | D | ug/l | 1.7 | J | 2.7 | | 1.7 | J | 2 | | 1.8 | J |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | T | ug/l | 5 | | 4.1 | | 3.2 | | 3.5 | | 3.1 | |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | D | ug/l | 14 | J | 24 | J | 50 | U | 50 | U | 38 | J |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | T | ug/l | 310 | | 1600 | | 930 | | 1000 | | 830 | |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | T | ug/l | 0.19 | J | 3.8 | | 2.4 | | 2.7 | | 2.6 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | D | ug/l | 7500 | | 5400 | | 6500 | | 6800 | | 7100 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | T | ug/l | 6500 | | 5600 | | 6700 | | 6600 | | 6900 | |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | D | ug/l | 5 | U | 5 | U | 5 | U | 5 | U | 6.2 | |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | T | ug/l | 26 | | 210 | | 150 | | 150 | | 130 | |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | D | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | T | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | D | ug/l | 1.6 | | 1.6 | | 1.5 | | 1.6 | | 1.8 | |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | T | ug/l | 2.7 | U | 3.2 | | 2.6 | | 2.5 | | 2.7 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | D | ug/l | 3600 | | 3700 | | 3800 | | 3900 | | 3900 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | T | ug/l | 3600 | | 3700 | | 3800 | | 3800 | | 3900 | |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | D | ug/l | 5 | U | 0.44 | J | 0.49 | J | 5 | U | 5 | U |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | T | ug/l | 5 | U | 5 | U | 5 | U | 0.86 | J | 5 | U |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | D | ug/l | 37000 | | 19000 | | 21000 | | 21000 | | 21000 | |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | T | ug/l | 38000 | | 19000 | | 21000 | | 20000 | | 21000 | |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | D | ug/l | 0.02 | J | 0.051 | J | 0.11 | J | 0.07 | J | 0.027 | J |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | T | ug/l | 1 | U | 0.024 | J | 0.02 | J | 0.028 | J | 0.025 | J |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 0.18 | J | 1 | U |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | T | ug/l | 1 | U | 2.5 | | 1.6 | | 2 | | 1.7 | |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | D | ug/l | 4.7 | J | 9.1 | J | 5 | J | 4.4 | J | 4.5 | J |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | T | ug/l | 5.5 | U | 12 | | 7.3 | | 8.8 | | 8.2 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | D | ug/l | 80000 | | 76000 | | 78000 | | 78000 | | 82000 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | T | ug/l | 80000 | | 70000 | | 80000 | | 80000 | | 84000 | |
| RA_SW_Other | HEM (Oil and Grease) | 348 | E1664B | N | ug/l | 2000 | J | | | 4800 | U | | | 48000 | U |
| RA_SW_PestPCBs | 4,4'-DDD | 72-54-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |

# Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK1 | | SUWBACK11 | | SUWBACK12 | | SUWBACK13 | | SUWBACK15 | |
| | | | | | sys_sample_code | SUWBACK1N | | SUWBACK11N | | SUWBACK12N | | SUWBACK13N | | SUWBACK15N | |
| | | | | | sample_date | 10/3/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 6.1 | | 1.8 | | 11.9 | | 5.15 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_PestPCBs | 4,4'-DDE | 72-55-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | 4,4'-DDT | 50-29-3 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0011 | J | | | 0.0012 | J |
| RA_SW_PestPCBs | Aldrin | 309-00-2 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | alpha-BHC | 319-84-6 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Aroclor-1016 | 12674-11-2 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1221 | 11104-28-2 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1232 | 11141-16-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1242 | 53469-21-9 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1248 | 12672-29-6 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1254 | 11097-69-1 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1260 | 11096-82-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1262 | 37324-23-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Aroclor-1268 | 11100-14-4 | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | beta-BHC | 319-85-7 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | cis-Chlordane | 5103-71-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | delta-BHC | 319-86-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Dieldrin | 60-57-1 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Endosulfan I | 959-98-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Endosulfan II | 33213-65-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Endosulfan Sulfate | 1031-07-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Endrin | 72-20-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Endrin aldehyde | 7421-93-4 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Endrin ketone | 53494-70-5 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | gamma-BHC (Lindane) | 58-89-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Heptachlor | 76-44-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Heptachlor Epoxide | 1024-57-3 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0013 | UJ |
| RA_SW_PestPCBs | Methoxychlor | 72-43-5 | SW8081B LL | N | ug/l | 0.0026 | U | | | 0.0026 | U | | | 0.0026 | UJ |
| RA_SW_PestPCBs | PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | PCB, Total Aroclors (Lab provided) | TOT-PCB-ARO | SW8082A LL | N | ug/l | 0.01 | U | 0.0094 | U | 0.01 | U | 0.01 | U | 0.01 | U |
| RA_SW_PestPCBs | Toxaphene | 8001-35-2 | SW8081B LL | N | ug/l | 0.1 | U | | | 0.1 | U | | | 0.1 | UJ |
| RA_SW_PestPCBs | trans-Chlordane | 5103-74-2 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0013 | U | | | 0.0012 | J |
| RA_SW_SVOCs | 1,1'-Biphenyl | 92-52-4 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 1,2,4,5-Tetrachlorobenzene | 95-94-3 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2,2'-oxybis(1-Chloropropane) | 108-60-1 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | 2,3,4,6-Tetrachlorophenol | 58-90-2 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2,4,5-Trichlorophenol | 95-95-4 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2,4,6-Trichlorophenol | 88-06-2 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2,4-Dichlorophenol | 120-83-2 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | 2,4-Dimethylphenol | 105-67-9 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2,4-Dinitrophenol | 51-28-5 | SW8270D LL | N | ug/l | 5.2 | U | | | 5.3 | U | | | 5.4 | U |
| RA_SW_SVOCs | 2,4-Dinitrotoluene | 121-14-2 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2,6-Dinitrotoluene | 606-20-2 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2-Chloronaphthalene | 91-58-7 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUWBACK1 | | SUWBACK11 | | SUWBACK12 | | SUWBACK13 | | SUWBACK15 | |
| | | | | | sys_sample_code | SUWBACK1N | | SUWBACK11N | | SUWBACK12N | | SUWBACK13N | | SUWBACK15N | |
| | | | | | sample_date | 10/3/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 6.1 | | 1.8 | | 11.9 | | 5.15 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | 2-Chlorophenol | 95-57-8 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2-Methylnaphthalene | 91-57-6 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | 2-Methylphenol | 95-48-7 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 2-Nitroaniline | 88-74-4 | SW8270D LL | N | ug/l | 5.2 | U | | | 5.3 | U | | | 5.4 | U |
| RA_SW_SVOCs | 2-Nitrophenol | 88-75-5 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 3-Nitroaniline | 99-09-2 | SW8270D LL | N | ug/l | 5.2 | U | | | 5.3 | U | | | 5.4 | U |
| RA_SW_SVOCs | 4,6-Dinitro-2-methylphenol | 534-52-1 | SW8270D LL | N | ug/l | 5.2 | U | | | 5.3 | U | | | 5.4 | U |
| RA_SW_SVOCs | 4-Bromophenyl-phenylether | 101-55-3 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 4-Chloro-3-methylphenol | 59-50-7 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 4-Chloroaniline | 106-47-8 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 4-Methylphenol | 106-44-5 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | 4-Nitroaniline | 100-01-6 | SW8270D LL | N | ug/l | 5.2 | U | | | 5.3 | U | | | 5.4 | U |
| RA_SW_SVOCs | 4-Nitrophenol | 100-02-7 | SW8270D LL | N | ug/l | 5.2 | U | | | 5.3 | U | | | 5.4 | U |
| RA_SW_SVOCs | Acenaphthene | 83-32-9 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Acenaphthylene | 208-96-8 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Acetophenone | 98-86-2 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Anthracene | 120-12-7 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Atrazine | 1912-24-9 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Benzaldehyde | 100-52-7 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Benzo(a)anthracene | 56-55-3 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Benzo(a)pyrene | 50-32-8 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Benzo(b)fluoranthene | 205-99-2 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Benzo(g,h,i)perylene | 191-24-2 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Benzo(k)fluoranthene | 207-08-9 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | bis-(2-chloroethoxy)methane | 111-91-1 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | bis-(2-Chloroethyl)ether | 111-44-4 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | bis-(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D LL | N | ug/l | 2.1 | U | | | 3.6 | | | | 2.2 | U |
| RA_SW_SVOCs | Butylbenzylphthalate | 85-68-7 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Caprolactam | 105-60-2 | SW8270D LL | N | ug/l | 5.2 | U | | | 5.3 | U | | | 5.4 | U |
| RA_SW_SVOCs | Carbazole | 86-74-8 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | Chrysene | 218-01-9 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Dibenzo(a,h)anthracene | 53-70-3 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Dibenzofuran | 132-64-9 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Diethylphthalate | 84-66-2 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Dimethylphthalate | 131-11-3 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Di-n-butylphthalate | 84-74-2 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Di-n-octylphthalate | 117-84-0 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Fluoranthene | 206-44-0 | SW8270D LL | N | ug/l | 0.21 | U | 0.028 | J | 0.21 | U | 0.018 | J | 0.22 | U |
| RA_SW_SVOCs | Fluorene | 86-73-7 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Hexachlorobenzene | 118-74-1 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | Hexachlorobutadiene | 87-68-3 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUWBACK1 | | SUWBACK11 | | SUWBACK12 | | SUWBACK13 | | SUWBACK15 | |
| | | | | | sys_sample_code | SUWBACK1N | | SUWBACK11N | | SUWBACK12N | | SUWBACK13N | | SUWBACK15N | |
| | | | | | sample_date | 10/3/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 6.1 | | 1.8 | | 11.9 | | 5.15 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | Hexachlorocyclo-pentadiene | 77-47-4 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Hexachloroethane | 67-72-1 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Isophorone | 78-59-1 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Naphthalene | 91-20-3 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Nitrobenzene | 98-95-3 | SW8270D LL | N | ug/l | 2.1 | U | | | 2.1 | U | | | 2.2 | U |
| RA_SW_SVOCs | N-Nitroso-di-n-propylamine | 621-64-7 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | N-Nitrosodiphenylamine | 86-30-6 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Pentachlorophenol | 87-86-5 | SW8270D LL | N | ug/l | 1 | U | | | 1.1 | U | | | 1.1 | U |
| RA_SW_SVOCs | Phenanthrene | 85-01-8 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Phenol | 108-95-2 | SW8270D LL | N | ug/l | 0.21 | U | | | 0.21 | U | | | 0.22 | U |
| RA_SW_SVOCs | Pyrene | 129-00-0 | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.02 | J | 0.22 | U |
| RA_SW_SVOCs | Total High-molecular-weight PAHs | TOT-PAH-HMW | SW8270D LL | N | ug/l | 0.21 | U | 0.028 | | 0.21 | U | 0.038 | | 0.22 | U |
| RA_SW_SVOCs | Total Low-molecular-weight PAHs | TOT-PAH-LMW | SW8270D LL | N | ug/l | 0.21 | U | 0.2 | U | 0.21 | U | 0.19 | U | 0.22 | U |
| RA_SW_SVOCs | Total PAHs (sum 16) | TOT-PAH | SW8270D LL | N | ug/l | 0.21 | U | 0.028 | | 0.21 | U | 0.038 | | 0.22 | U |
| RA_SW_VOCs | 1,1,1-Trichloroethane | 71-55-6 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,1,2,2-Tetrachloroethane | 79-34-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,1,2-Trichloroethane | 79-00-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,1-Dichloroethane | 75-34-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,1-Dichloroethene | 75-35-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,2,3-Trichlorobenzene | 87-61-6 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,2,4-Trichlorobenzene | 120-82-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,2-Dibromo-3-chloropropane | 96-12-8 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,2-Dibromoethane | 106-93-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,2-Dichlorobenzene | 95-50-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,2-Dichloroethane | 107-06-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,2-Dichloropropane | 78-87-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,3-Dichlorobenzene | 541-73-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,4-Dichlorobenzene | 106-46-7 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | 1,4-Dioxane | 123-91-1 | SW8260B | N | ug/l | 200 | U | | | 200 | U | | | 200 | U |
| RA_SW_VOCs | 2-Butanone | 78-93-3 | SW8260B | N | ug/l | 5 | U | | | 5 | U | | | 5 | U |
| RA_SW_VOCs | 2-Hexanone | 591-78-6 | SW8260B | N | ug/l | 5 | U | | | 5 | U | | | 5 | U |
| RA_SW_VOCs | 4-Methyl-2-pentanone | 108-10-1 | SW8260B | N | ug/l | 5 | U | | | 5 | U | | | 5 | U |
| RA_SW_VOCs | Acetone | 67-64-1 | SW8260B | N | ug/l | 3.7 | J | | | 5 | U | | | 5 | U |
| RA_SW_VOCs | Benzene | 71-43-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Bromochloromethane | 74-97-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Bromodichloromethane | 75-27-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Bromoform | 75-25-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Bromomethane | 74-83-9 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Carbon Disulfide | 75-15-0 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Carbon Tetrachloride | 56-23-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Chlorobenzene | 108-90-7 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK1 | | SUWBACK11 | | SUWBACK12 | | SUWBACK13 | | SUWBACK15 | |
| | | | | | sys_sample_code | SUWBACK1N | | SUWBACK11N | | SUWBACK12N | | SUWBACK13N | | SUWBACK15N | |
| | | | | | sample_date | 10/3/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 6.1 | | 1.8 | | 11.9 | | 5.15 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_VOCs | Chloroethane | 75-00-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Chloroform | 67-66-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Chloromethane | 74-87-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | cis-1,2-Dichloroethylene | 156-59-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | cis-1,3-Dichloropropene | 10061-01-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Cyclohexane | 110-82-7 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Dibromochloromethane | 124-48-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Dichlorodifluoromethane | 75-71-8 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Ethylbenzene | 100-41-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Isopropylbenzene | 98-82-8 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | m, p-Xylene | XYLMP | SW8260B | N | ug/l | 2 | U | | | 2 | U | | | 2 | U |
| RA_SW_VOCs | Methyl Acetate | 79-20-9 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Methyl tert-Butyl Ether (MTBE) | 1634-04-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Methylcyclohexane | 108-87-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Methylene Chloride | 75-09-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | o-Xylene | 95-47-6 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Styrene | 100-42-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Tetrachloroethylene | 127-18-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Toluene | 108-88-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | trans-1,2-Dichloroethene | 156-60-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | trans-1,3-Dichloropropene | 10061-02-6 | SW8260B | N | ug/l | 1 | UJ | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Trichloroethene | 79-01-6 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Trichlorofluoromethane | 75-69-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Vinyl Chloride | 75-01-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | | | 1 | U |
| RA_SW_VOCs | Xylenes (total) | 1330-20-7 | SW8260B | N | ug/l | 2 | U | | | 2 | U | | | 2 | U |

# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK2 | | SUWBACK3 | | SUWBACK4 | | SUWBACK5 | | SUWBACK6 | |
| | | | | | sys_sample_code | SUWBACK2N | | SUWBACK3N | | SUWBACK4N | | SUWBACK5N | | SUWBACK6N | |
| | | | | | sample_date | 10/3/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 1.5 | | 7.6 | | 5.1 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDD | 35822-46-9 | SW8290A | N | ug/l | 5.21E-07 | U | | | 8.86E-06 | J | 4.87E-06 | J | | |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDF | 67562-39-4 | SW8290A | N | ug/l | 4.12E-08 | U | | | 8.66E-07 | J | 6.57E-07 | J | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8,9-HpCDF | 55673-89-7 | SW8290A | N | ug/l | 5.64E-08 | U | | | 1.1E-07 | U | 1.13E-07 | U | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDD | 39227-28-6 | SW8290A | N | ug/l | 4.46E-07 | J | | | 8.47E-08 | U | 8.31E-08 | U | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDF | 70648-26-9 | SW8290A | N | ug/l | 3.19E-08 | U | | | 1.13E-07 | U | 4.54E-07 | J | | |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDD | 57653-85-7 | SW8290A | N | ug/l | 4.28E-08 | U | | | 8.19E-08 | U | 8.57E-08 | U | | |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDF | 57117-44-9 | SW8290A | N | ug/l | 2.97E-08 | U | | | 1.09E-07 | U | 1.02E-06 | J | | |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDD | 19408-74-3 | SW8290A | N | ug/l | 3.81E-08 | U | | | 5.41E-07 | J | 7.64E-08 | U | | |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDF | 72918-21-9 | SW8290A | N | ug/l | 3.36E-08 | U | | | 1.33E-07 | U | 1.03E-07 | U | | |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDD | 40321-76-4 | SW8290A | N | ug/l | 2E-08 | U | | | 4.59E-08 | U | 5.77E-08 | U | | |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDF | 57117-41-6 | SW8290A | N | ug/l | 1.2E-07 | J | | | 2.1E-07 | J | 1.04E-07 | U | | |
| RA_SW_DioxinFurans | 2,3,4,6,7,8-HxCDF | 60851-34-5 | SW8290A | N | ug/l | 1.15E-07 | J | | | 5.97E-07 | J | 8.49E-08 | U | | |
| RA_SW_DioxinFurans | 2,3,4,7,8-PeCDF | 57117-31-4 | SW8290A | N | ug/l | 3.41E-08 | U | | | 7.5E-08 | U | 9.55E-08 | U | | |
| RA_SW_DioxinFurans | 2,3,7,8-TCDD | 1746-01-6 | SW8290A | N | ug/l | 4.01E-08 | U | | | 4.08E-08 | U | 6.93E-08 | U | | |
| RA_SW_DioxinFurans | 2,3,7,8-TCDF | 51207-31-9 | SW8290A | N | ug/l | 2.21E-08 | U | | | 5.01E-08 | U | 9.97E-08 | U | | |
| RA_SW_DioxinFurans | OCDD | 3268-87-9 | SW8290A | N | ug/l | 9.34E-06 | U | | | 0.000228 | | 0.000183 | | | |
| RA_SW_DioxinFurans | OCDF | 39001-02-0 | SW8290A | N | ug/l | 3.73E-07 | U | | | 8.27E-07 | J | 1.41E-06 | J | | |
| RA_SW_DioxinFurans | TCDD TEQ Bird | DFTEQ-Bird | SW8290A | N | ug/l | 4.58E-08 | | | | 1.75E-07 | | 1.77E-07 | | | |
| RA_SW_DioxinFurans | TCDD TEQ Fish | DFTEQ-Fish | SW8290A | N | ug/l | 2.41E-07 | | | | 1.16E-07 | | 1.77E-07 | | | |
| RA_SW_DioxinFurans | TCDD TEQ HH | DFTEQ-HH | SW8290A | N | ug/l | 5.97E-08 | | | | 2.86E-07 | | 2.58E-07 | | | |
| RA_SW_DioxinFurans | Total HpCDD | 37871-00-4 | SW8290A | N | ug/l | 1.97E-06 | J | | | 1.66E-05 | J | 1.08E-05 | J | | |
| RA_SW_DioxinFurans | Total HpCDF | 38998-75-3 | SW8290A | N | ug/l | 4.78E-08 | U | | | 2.15E-06 | J | 6.57E-07 | J | | |
| RA_SW_DioxinFurans | Total HxCDD | 34465-46-8 | SW8290A | N | ug/l | 1.05E-06 | U | | | 5.41E-07 | J | 1.68E-06 | J | | |
| RA_SW_DioxinFurans | Total HxCDF | 55684-94-1 | SW8290A | N | ug/l | 1.15E-07 | U | | | 4.79E-06 | J | 5.57E-06 | J | | |
| RA_SW_DioxinFurans | Total PeCDD | 36088-22-9 | SW8290A | N | ug/l | 2E-08 | U | | | 4.59E-08 | U | 5.77E-08 | U | | |
| RA_SW_DioxinFurans | Total PeCDF | 30402-15-4 | SW8290A | N | ug/l | 1.2E-07 | U | | | 4.22E-06 | J | 6.4E-06 | J | | |
| RA_SW_DioxinFurans | Total TCDD | 41903-57-5 | SW8290A | N | ug/l | 4.01E-08 | U | | | 4.08E-08 | U | 6.93E-08 | U | | |
| RA_SW_DioxinFurans | Total TCDF | 55722-27-5 | SW8290A | N | ug/l | 2.21E-08 | U | | | 4.06E-06 | J | 1.06E-05 | J | | |
| RA_SW_DioxinFurans | Total TEQ | TTEQ | SW8290A | N | ug/l | 5.97E-08 | | | | 2.86E-07 | | 2.58E-07 | | | |
| RA_SW_Field | Conductivity | Cond | FIELD | T | ms/cm | 0.47 | | 0.316 | | 0.266 | | 0.24 | | 0.228 | |
| RA_SW_Field | DO | DO | FIELD | T | mg/l | 10.24 | | 7.55 | | 5.11 | | 5.13 | | 4.13 | |
| RA_SW_Field | OXIDATION-REDUCTION POTENTIAL | ORP | FIELD | T | mV | 31.7 | | 45.2 | | 20.1 | | 23.2 | | 53.6 | |
| RA_SW_Field | PH | PH | FIELD | T | ph units | 7.11 | | 6.91 | | 7 | | 7.03 | | 6.65 | |
| RA_SW_Field | SALINITY | SAL | FIELD | T | ppt | 0.23 | | 0.15 | | 0.13 | | 0.11 | | 0.11 | |
| RA_SW_Field | TEMPERATURE | TEMP | FIELD | T | deg F | 68.3 | | 66.02 | | 64.32 | | 64.85 | | 68.13 | |
| RA_SW_Field | TURBIDITY | TURB | FIELD | T | ntu | 1.4 | | 2.5 | | 21.3 | | 17.2 | | 7.2 | |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | D | ug/l | 6.1 | J | 30 | U | 30 | U | 30 | U | 30 | U |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | T | ug/l | 35 | | 150 | | 300 | | 270 | | 310 | |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | D | ug/l | 0.25 | J | 0.54 | J | 0.66 | J | 0.75 | J | 0.73 | J |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | T | ug/l | 0.23 | J | 0.37 | J | 0.47 | J | 0.51 | J | 0.53 | J |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 0.49 | J |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | T | ug/l | 2.4 | | 0.34 | J | 0.68 | J | 0.97 | J | 0.69 | J |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | D | ug/l | 58 | | 39 | | 33 | | 31 | | 31 | |

# Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK2 | | SUWBACK3 | | SUWBACK4 | | SUWBACK5 | | SUWBACK6 | |
| | | | | | sys_sample_code | SUWBACK2N | | SUWBACK3N | | SUWBACK4N | | SUWBACK5N | | SUWBACK6N | |
| | | | | | sample_date | 10/3/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 1.5 | | 7.6 | | 5.1 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | T | ug/l | 60 | | 44 | | 40 | | 36 | | 36 | |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | T | ug/l | 0.21 | J | 0.037 | J | 0.086 | J | 0.063 | J | 0.058 | J |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | D | ug/l | 32000 | | 21000 | | 18000 | | 16000 | | 16000 | |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | T | ug/l | 36000 | | 20000 | | 18000 | | 16000 | | 16000 | |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | D | ug/l | 2 | | 1.6 | J | 1.5 | J | 1.6 | J | 1.4 | J |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | T | ug/l | 0.85 | J | 2.2 | | 2.6 | | 2.4 | | 2.4 | |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | D | ug/l | 0.09 | J | 0.16 | J | 0.12 | J | 0.12 | J | 0.11 | J |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | T | ug/l | 0.49 | J | 1.4 | | 1.3 | | 1.1 | | 1 | |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | D | ug/l | 1.7 | J | 1.7 | J | 1.7 | J | 1.7 | J | 1.7 | J |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | T | ug/l | 4.4 | | 2.7 | | 3.3 | | 3.1 | | 3.1 | |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | D | ug/l | 50 | U | 50 | U | 50 | U | 6.3 | J | 7 | J |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | T | ug/l | 440 | | 1100 | | 1300 | | 1100 | | 1100 | |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | T | ug/l | 0.19 | J | 1.2 | | 2 | | 2.2 | | 2.2 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | D | ug/l | 10000 | | 6400 | | 5300 | | 4600 | | 4500 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | T | ug/l | 9200 | | 6300 | | 5300 | | 4600 | | 4400 | |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | D | ug/l | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | T | ug/l | 60 | | 260 | | 260 | | 190 | | 170 | |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | D | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | T | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | D | ug/l | 2.7 | | 1.8 | | 1.8 | | 1.6 | | 1.5 | |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | T | ug/l | 4 | U | 3 | | 3.2 | | 2.6 | | 2.7 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | D | ug/l | 4900 | | 3800 | | 3600 | | 3300 | | 3400 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | T | ug/l | 4900 | | 3700 | | 3600 | | 3300 | | 3300 | |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | D | ug/l | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | T | ug/l | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | D | ug/l | 38000 | | 27000 | | 21000 | | 18000 | | 18000 | |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | T | ug/l | 39000 | | 26000 | | 20000 | | 18000 | | 17000 | |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | D | ug/l | 0.027 | J | 0.021 | J | 1 | U | 0.023 | J | 1 | U |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | T | ug/l | 1 | U | 0.025 | J | 0.034 | J | 0.029 | J | 0.022 | J |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | D | ug/l | 0.11 | J | 1 | U | 1 | U | 0.16 | J | 1 | U |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | T | ug/l | 1 | U | 1.5 | | 1.8 | | 1.7 | | 2.4 | |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | D | ug/l | 8.9 | | 3.3 | J | 4.2 | J | 3.3 | J | 7.9 | J |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | T | ug/l | 10 | U | 5.5 | | 8.5 | | 7.6 | | 7.4 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | D | ug/l | 130000 | | 76000 | | 66000 | | 58000 | | 56000 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | T | ug/l | 130000 | | 80000 | | 68000 | | 60000 | | 60000 | |
| RA_SW_Other | HEM (Oil and Grease) | 348 | E1664B | N | ug/l | 2200 | J | | | 4800 | U | 2300 | J | | |
| RA_SW_PestPCBs | 4,4'-DDD | 72-54-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |

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Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK2 | | SUWBACK3 | | SUWBACK4 | | SUWBACK5 | | SUWBACK6 | |
| | | | | | sys_sample_code | SUWBACK2N | | SUWBACK3N | | SUWBACK4N | | SUWBACK5N | | SUWBACK6N | |
| | | | | | sample_date | 10/3/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 1.5 | | 7.6 | | 5.1 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_PestPCBs | 4,4'-DDE | 72-55-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | 4,4'-DDT | 50-29-3 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | | 0.00081 | J | | |
| RA_SW_PestPCBs | Aldrin | 309-00-2 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | alpha-BHC | 319-84-6 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Aroclor-1016 | 12674-11-2 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1221 | 11104-28-2 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1232 | 11141-16-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1242 | 53469-21-9 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1248 | 12672-29-6 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1254 | 11097-69-1 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1260 | 11096-82-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1262 | 37324-23-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Aroclor-1268 | 11100-14-4 | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | beta-BHC | 319-85-7 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | cis-Chlordane | 5103-71-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | delta-BHC | 319-86-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Dieldrin | 60-57-1 | SW8081B LL | N | ug/l | 0.0011 | J | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Endosulfan I | 959-98-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Endosulfan II | 33213-65-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Endosulfan Sulfate | 1031-07-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Endrin | 72-20-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Endrin aldehyde | 7421-93-4 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Endrin ketone | 53494-70-5 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | gamma-BHC (Lindane) | 58-89-9 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Heptachlor | 76-44-8 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Heptachlor Epoxide | 1024-57-3 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_PestPCBs | Methoxychlor | 72-43-5 | SW8081B LL | N | ug/l | 0.0025 | U | | | 0.0024 | U | 0.0024 | U | | |
| RA_SW_PestPCBs | PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | PCB, Total Aroclors (Lab provided) | TOT-PCB-ARO | SW8082A LL | N | ug/l | 0.01 | U | 0.0095 | U | 0.0095 | U | 0.0095 | U | 0.0094 | U |
| RA_SW_PestPCBs | Toxaphene | 8001-35-2 | SW8081B LL | N | ug/l | 0.1 | U | | | 0.095 | U | 0.095 | U | | |
| RA_SW_PestPCBs | trans-Chlordane | 5103-74-2 | SW8081B LL | N | ug/l | 0.0013 | U | | | 0.0012 | U | 0.0012 | U | | |
| RA_SW_SVOCs | 1,1'-Biphenyl | 92-52-4 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 1,2,4,5-Tetrachlorobenzene | 95-94-3 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2,2'-oxybis(1-Chloropropane) | 108-60-1 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | 2,3,4,6-Tetrachlorophenol | 58-90-2 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2,4,5-Trichlorophenol | 95-95-4 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2,4,6-Trichlorophenol | 88-06-2 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2,4-Dichlorophenol | 120-83-2 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | 2,4-Dimethylphenol | 105-67-9 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2,4-Dinitrophenol | 51-28-5 | SW8270D LL | N | ug/l | 5 | U | | | 4.8 | U | 4.9 | U | | |
| RA_SW_SVOCs | 2,4-Dinitrotoluene | 121-14-2 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2,6-Dinitrotoluene | 606-20-2 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2-Chloronaphthalene | 91-58-7 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |

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# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
| | | | | | sys_loc_code | SUWBACK2 | | SUWBACK3 | | SUWBACK4 | | SUWBACK5 | | SUWBACK6 | |
| | | | | | sys_sample_code | SUWBACK2N | | SUWBACK3N | | SUWBACK4N | | SUWBACK5N | | SUWBACK6N | |
| | | | | | sample_date | 10/3/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 1.5 | | 7.6 | | 5.1 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | 2-Chlorophenol | 95-57-8 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2-Methylnaphthalene | 91-57-6 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | 2-Methylphenol | 95-48-7 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 2-Nitroaniline | 88-74-4 | SW8270D LL | N | ug/l | 5 | U | | | 4.8 | U | 4.9 | U | | |
| RA_SW_SVOCs | 2-Nitrophenol | 88-75-5 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 3-Nitroaniline | 99-09-2 | SW8270D LL | N | ug/l | 5 | U | | | 4.8 | U | 4.9 | U | | |
| RA_SW_SVOCs | 4,6-Dinitro-2-methylphenol | 534-52-1 | SW8270D LL | N | ug/l | 5 | U | | | 4.8 | U | 4.9 | U | | |
| RA_SW_SVOCs | 4-Bromophenyl-phenylether | 101-55-3 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 4-Chloro-3-methylphenol | 59-50-7 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 4-Chloroaniline | 106-47-8 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 4-Methylphenol | 106-44-5 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | 4-Nitroaniline | 100-01-6 | SW8270D LL | N | ug/l | 5 | U | | | 4.8 | U | 4.9 | U | | |
| RA_SW_SVOCs | 4-Nitrophenol | 100-02-7 | SW8270D LL | N | ug/l | 5 | U | | | 4.8 | U | 4.9 | U | | |
| RA_SW_SVOCs | Acenaphthene | 83-32-9 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Acenaphthylene | 208-96-8 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Acetophenone | 98-86-2 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Anthracene | 120-12-7 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Atrazine | 1912-24-9 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Benzaldehyde | 100-52-7 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Benzo(a)anthracene | 56-55-3 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(a)pyrene | 50-32-8 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(b)fluoranthene | 205-99-2 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(g,h,i)perylene | 191-24-2 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(k)fluoranthene | 207-08-9 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | bis-(2-chloroethoxy)methane | 111-91-1 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | bis-(2-Chloroethyl)ether | 111-44-4 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | bis-(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D LL | N | ug/l | 2 | U | | | 2.8 | | 2.4 | | | |
| RA_SW_SVOCs | Butylbenzylphthalate | 85-68-7 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.16 | J | 0.97 | U | | |
| RA_SW_SVOCs | Caprolactam | 105-60-2 | SW8270D LL | N | ug/l | 5 | U | | | 4.8 | U | 4.9 | U | | |
| RA_SW_SVOCs | Carbazole | 86-74-8 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | Chrysene | 218-01-9 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Dibenzo(a,h)anthracene | 53-70-3 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Dibenzofuran | 132-64-9 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Diethylphthalate | 84-66-2 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Dimethylphthalate | 131-11-3 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Di-n-butylphthalate | 84-74-2 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.12 | J | | |
| RA_SW_SVOCs | Di-n-octylphthalate | 117-84-0 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Fluoranthene | 206-44-0 | SW8270D LL | N | ug/l | 0.2 | U | 0.024 | J | 0.031 | J | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Fluorene | 86-73-7 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Hexachlorobenzene | 118-74-1 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | Hexachlorobutadiene | 87-68-3 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |

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# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUWBACK2 | | SUWBACK3 | | SUWBACK4 | | SUWBACK5 | | SUWBACK6 | |
| | | | | | sys_sample_code | SUWBACK2N | | SUWBACK3N | | SUWBACK4N | | SUWBACK5N | | SUWBACK6N | |
| | | | | | sample_date | 10/3/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 1.5 | | 7.6 | | 5.1 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | Hexachlorocyclo-pentadiene | 77-47-4 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Hexachloroethane | 67-72-1 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Isophorone | 78-59-1 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Naphthalene | 91-20-3 | SW8270D LL | N | ug/l | 0.2 | U | 0.19 | U | 0.025 | J | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Nitrobenzene | 98-95-3 | SW8270D LL | N | ug/l | 2 | U | | | 1.9 | U | 1.9 | U | | |
| RA_SW_SVOCs | N-Nitroso-di-n-propylamine | 621-64-7 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | N-Nitrosodiphenylamine | 86-30-6 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Pentachlorophenol | 87-86-5 | SW8270D LL | N | ug/l | 0.99 | U | | | 0.96 | U | 0.97 | U | | |
| RA_SW_SVOCs | Phenanthrene | 85-01-8 | SW8270D LL | N | ug/l | 0.2 | U | 0.048 | J | 0.19 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Phenol | 108-95-2 | SW8270D LL | N | ug/l | 0.2 | U | | | 0.19 | U | 0.19 | U | | |
| RA_SW_SVOCs | Pyrene | 129-00-0 | SW8270D LL | N | ug/l | 0.2 | U | 0.022 | J | 0.023 | J | 0.19 | U | 0.019 | J |
| RA_SW_SVOCs | Total High-molecular-weight PAHs | TOT-PAH-HMW | SW8270D LL | N | ug/l | 0.2 | U | 0.046 | | 0.054 | | 0.19 | U | 0.019 | |
| RA_SW_SVOCs | Total Low-molecular-weight PAHs | TOT-PAH-LMW | SW8270D LL | N | ug/l | 0.2 | U | 0.048 | | 0.025 | | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Total PAHs (sum 16) | TOT-PAH | SW8270D LL | N | ug/l | 0.2 | U | 0.094 | | 0.079 | | 0.19 | U | 0.019 | |
| RA_SW_VOCs | 1,1,1-Trichloroethane | 71-55-6 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,1,2,2-Tetrachloroethane | 79-34-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,1,2-Trichloroethane | 79-00-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,1-Dichloroethane | 75-34-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,1-Dichloroethene | 75-35-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,2,3-Trichlorobenzene | 87-61-6 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,2,4-Trichlorobenzene | 120-82-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,2-Dibromo-3-chloropropane | 96-12-8 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,2-Dibromoethane | 106-93-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,2-Dichlorobenzene | 95-50-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,2-Dichloroethane | 107-06-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,2-Dichloropropane | 78-87-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,3-Dichlorobenzene | 541-73-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,4-Dichlorobenzene | 106-46-7 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | 1,4-Dioxane | 123-91-1 | SW8260B | N | ug/l | 200 | U | | | 200 | U | 200 | U | | |
| RA_SW_VOCs | 2-Butanone | 78-93-3 | SW8260B | N | ug/l | 5 | U | | | 5 | U | 5 | U | | |
| RA_SW_VOCs | 2-Hexanone | 591-78-6 | SW8260B | N | ug/l | 5 | U | | | 5 | U | 5 | U | | |
| RA_SW_VOCs | 4-Methyl-2-pentanone | 108-10-1 | SW8260B | N | ug/l | 5 | U | | | 5 | U | 5 | U | | |
| RA_SW_VOCs | Acetone | 67-64-1 | SW8260B | N | ug/l | 3 | J | | | 5 | U | 5 | U | | |
| RA_SW_VOCs | Benzene | 71-43-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Bromochloromethane | 74-97-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Bromodichloromethane | 75-27-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Bromoform | 75-25-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Bromomethane | 74-83-9 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Carbon Disulfide | 75-15-0 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Carbon Tetrachloride | 56-23-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Chlorobenzene | 108-90-7 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Background | | RA_Background | | RA_Background | | RA_Background | | RA_Background | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUWBACK2 | | SUWBACK3 | | SUWBACK4 | | SUWBACK5 | | SUWBACK6 | |
| | | | | | sys_sample_code | SUWBACK2N | | SUWBACK3N | | SUWBACK4N | | SUWBACK5N | | SUWBACK6N | |
| | | | | | sample_date | 10/3/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | | 9/26/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 0.5 | | 1.5 | | 7.6 | | 5.1 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_VOCs | Chloroethane | 75-00-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Chloroform | 67-66-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Chloromethane | 74-87-3 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | cis-1,2-Dichloroethylene | 156-59-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | cis-1,3-Dichloropropene | 10061-01-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Cyclohexane | 110-82-7 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Dibromochloromethane | 124-48-1 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Dichlorodifluoromethane | 75-71-8 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Ethylbenzene | 100-41-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Isopropylbenzene | 98-82-8 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | m, p-Xylene | XYLMP | SW8260B | N | ug/l | 2 | U | | | 0.43 | J | 2 | U | | |
| RA_SW_VOCs | Methyl Acetate | 79-20-9 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Methyl tert-Butyl Ether (MTBE) | 1634-04-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Methylcyclohexane | 108-87-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Methylene Chloride | 75-09-2 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | o-Xylene | 95-47-6 | SW8260B | N | ug/l | 1 | U | | | 0.17 | J | 0.12 | J | | |
| RA_SW_VOCs | Styrene | 100-42-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Tetrachloroethylene | 127-18-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Toluene | 108-88-3 | SW8260B | N | ug/l | 1 | U | | | 0.3 | J | 1 | U | | |
| RA_SW_VOCs | trans-1,2-Dichloroethene | 156-60-5 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | trans-1,3-Dichloropropene | 10061-02-6 | SW8260B | N | ug/l | 1 | UJ | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Trichloroethene | 79-01-6 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Trichlorofluoromethane | 75-69-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Vinyl Chloride | 75-01-4 | SW8260B | N | ug/l | 1 | U | | | 1 | U | 1 | U | | |
| RA_SW_VOCs | Xylenes (total) | 1330-20-7 | SW8260B | N | ug/l | 2 | U | | | 0.6 | | 0.12 | | | |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019



| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW10B | | SUW1B | | SUW2B | | SUW3C | | SUW4B | |
| | | | | | sys_sample_code | SUW10BN | | SUW1BN | | SUW2BN | | SUW3CN | | SUW4BN | |
| | | | | | sample_date | 9/26/2013 | | 9/23/2013 | | 9/23/2013 | | 9/23/2013 | | 9/24/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 7.3 | | 12.8 | | 5.3 | | 5.8 | | 5.7 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDD | 35822-46-9 | SW8290A | N | ug/l | 7.71E-06 | J | 6.59E-06 | J | | | 7E-06 | J | | |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDF | 67562-39-4 | SW8290A | N | ug/l | 1.47E-06 | J | 1.41E-06 | J | | | 1.41E-06 | J | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8,9-HpCDF | 55673-89-7 | SW8290A | N | ug/l | 1.44E-07 | U | 6.01E-07 | J | | | 5.52E-07 | J | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDD | 39227-28-6 | SW8290A | N | ug/l | 8.18E-08 | U | 8.87E-08 | U | | | 8.98E-08 | U | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDF | 70648-26-9 | SW8290A | N | ug/l | 1.03E-07 | U | 9.35E-08 | U | | | 6.8E-07 | J | | |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDD | 57653-85-7 | SW8290A | N | ug/l | 8.08E-08 | U | 4.2E-07 | J | | | 2.88E-07 | U | | |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDF | 57117-44-9 | SW8290A | N | ug/l | 1.08E-07 | U | 9.46E-08 | U | | | 7.96E-07 | J | | |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDD | 19408-74-3 | SW8290A | N | ug/l | 7.36E-08 | U | 4.43E-07 | J | | | 7.36E-07 | J | | |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDF | 72918-21-9 | SW8290A | N | ug/l | 9.04E-07 | J | 1.98E-07 | J | | | 3.62E-07 | J | | |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDD | 40321-76-4 | SW8290A | N | ug/l | 4.21E-08 | U | 5.09E-08 | U | | | 5.39E-08 | U | | |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDF | 57117-41-6 | SW8290A | N | ug/l | 8.73E-08 | U | 1.84E-07 | U | | | 1.01E-07 | U | | |
| RA_SW_DioxinFurans | 2,3,4,6,7,8-HxCDF | 60851-34-5 | SW8290A | N | ug/l | 9.11E-08 | U | 2.75E-07 | U | | | 8.43E-08 | U | | |
| RA_SW_DioxinFurans | 2,3,4,7,8-PeCDF | 57117-31-4 | SW8290A | N | ug/l | 8.37E-08 | U | 8.5E-08 | U | | | 8.38E-08 | U | | |
| RA_SW_DioxinFurans | 2,3,7,8-TCDD | 1746-01-6 | SW8290A | N | ug/l | 7.21E-08 | U | 6.23E-08 | U | | | 1.48E-07 | J | | |
| RA_SW_DioxinFurans | 2,3,7,8-TCDF | 51207-31-9 | SW8290A | N | ug/l | 8E-08 | U | 7.75E-08 | U | | | 4.19E-07 | J | | |
| RA_SW_DioxinFurans | OCDD | 3268-87-9 | SW8290A | N | ug/l | 0.000191 | | 0.00019 | | | | 0.000248 | | | |
| RA_SW_DioxinFurans | OCDF | 39001-02-0 | SW8290A | N | ug/l | 1.96E-06 | J | 2.95E-06 | J | | | 3.35E-06 | J | | |
| RA_SW_DioxinFurans | TCDD TEQ Bird | DFTEQ-Bird | SW8290A | N | ug/l | 1.32E-07 | | 1.14E-07 | | | | 8.76E-07 | | | |
| RA_SW_DioxinFurans | TCDD TEQ Fish | DFTEQ-Fish | SW8290A | N | ug/l | 1.32E-07 | | 7.44E-08 | | | | 4.12E-07 | | | |
| RA_SW_DioxinFurans | TCDD TEQ HH | DFTEQ-HH | SW8290A | N | ug/l | 2.4E-07 | | 2.5E-07 | | | | 6.12E-07 | | | |
| RA_SW_DioxinFurans | Total HpCDD | 37871-00-4 | SW8290A | N | ug/l | 1.68E-05 | J | 1.59E-05 | J | | | 1.71E-05 | J | | |
| RA_SW_DioxinFurans | Total HpCDF | 38998-75-3 | SW8290A | N | ug/l | 1.47E-06 | J | 2.88E-06 | J | | | 1.96E-06 | J | | |
| RA_SW_DioxinFurans | Total HxCDD | 34465-46-8 | SW8290A | N | ug/l | 8.07E-07 | J | 3.42E-06 | J | | | 3.77E-06 | J | | |
| RA_SW_DioxinFurans | Total HxCDF | 55684-94-1 | SW8290A | N | ug/l | 5E-06 | J | 5.67E-06 | J | | | 9.11E-06 | J | | |
| RA_SW_DioxinFurans | Total PeCDD | 36088-22-9 | SW8290A | N | ug/l | 4.21E-08 | U | 3.08E-06 | J | | | 5.39E-08 | U | | |
| RA_SW_DioxinFurans | Total PeCDF | 30402-15-4 | SW8290A | N | ug/l | 6.82E-06 | J | 1.02E-05 | J | | | 1.33E-05 | J | | |
| RA_SW_DioxinFurans | Total TCDD | 41903-57-5 | SW8290A | N | ug/l | 7.21E-08 | U | 1.1E-07 | U | | | 1.48E-07 | U | | |
| RA_SW_DioxinFurans | Total TCDF | 55722-27-5 | SW8290A | N | ug/l | 1.05E-05 | J | 1.6E-05 | J | | | 2.12E-05 | J | | |
| RA_SW_DioxinFurans | Total TEQ | TTEQ | SW8290A | N | ug/l | 2.4E-07 | | 2.5E-07 | | | | 6.12E-07 | | | |
| RA_SW_Field | Conductivity | Cond | FIELD | T | ms/cm | 0.228 | | 0.263 | | 0.231 | | 0.198 | | 0.215 | |
| RA_SW_Field | DO | DO | FIELD | T | mg/l | 3.94 | | 3.41 | | 3.79 | | 3.94 | | 3.35 | |
| RA_SW_Field | OXIDATION-REDUCTION POTENTIAL | ORP | FIELD | T | mV | 79.8 | | 29.6 | | 48.1 | | 41.1 | | 98.6 | |
| RA_SW_Field | PH | PH | FIELD | T | ph units | 6.81 | | 6.81 | | 6.82 | | 6.67 | | 6.67 | |
| RA_SW_Field | SALINITY | SAL | FIELD | T | ppt | 0.11 | | 0.13 | | 0.11 | | 0.09 | | 0.1 | |
| RA_SW_Field | TEMPERATURE | TEMP | FIELD | T | deg F | 65.62 | | 67.87 | | 67.8 | | 68.2 | | 66.48 | |
| RA_SW_Field | TURBIDITY | TURB | FIELD | T | ntu | 24.9 | | 0 | | 15 | | 4.3 | | 6.5 | |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | D | ug/l | 30 | U | 30 | U | 30 | U | 30 | U | 30 | U |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | T | ug/l | 310 | | 460 | | 330 | | 570 | | 380 | |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | D | ug/l | 0.74 | J | 0.92 | J | 0.84 | J | 1.8 | J | 0.78 | J |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | T | ug/l | 0.56 | J | 0.62 | J | 0.63 | J | 0.62 | J | 0.57 | J |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | D | ug/l | 0.32 | J | 1 | U | 0.41 | J | 1 | U | 0.56 | J |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | T | ug/l | 0.62 | J | 0.73 | J | 0.59 | J | 0.7 | J | 1.2 | J |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | D | ug/l | 30 | | 36 | | 34 | | 30 | | 31 | |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW10B | | SUW1B | | SUW2B | | SUW3C | | SUW4B | |
| | | | | | sys_sample_code | SUW10BN | | SUW1BN | | SUW2BN | | SUW3CN | | SUW4BN | |
| | | | | | sample_date | 9/26/2013 | | 9/23/2013 | | 9/23/2013 | | 9/23/2013 | | 9/24/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 7.3 | | 12.8 | | 5.3 | | 5.8 | | 5.7 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | T | ug/l | 35 | | 41 | | 36 | | 33 | | 36 | |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | D | ug/l | 1 | U | 0.045 | J | 1 | U | 0.079 | J | 1 | U |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | T | ug/l | 0.048 | J | 0.038 | J | 0.093 | J | 0.1 | J | 0.079 | J |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | D | ug/l | 15000 | | 19000 | | 17000 | | 14000 | | 15000 | |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | T | ug/l | 15000 | | 19000 | | 16000 | | 14000 | | 15000 | |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | D | ug/l | 1.7 | J | 2.3 | | 2.1 | | 2.2 | | 2 | |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | T | ug/l | 2.7 | | 3.3 | | 2.9 | | 3.5 | | 2.9 | |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | D | ug/l | 0.093 | J | 0.31 | J | 0.23 | J | 0.71 | | 0.24 | J |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | T | ug/l | 1.1 | | 0.96 | | 0.93 | | 1.1 | | 1 | |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | D | ug/l | 1.8 | J | 2.7 | | 3.3 | | 3.9 | | 2.7 | |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | T | ug/l | 3.3 | | 3.9 | | 4.1 | | 4.8 | | 5.8 | |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | D | ug/l | 9.1 | J | 50 | U | 18 | J | 11 | J | 11 | J |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | T | ug/l | 1100 | | 1200 | | 1000 | | 1400 | | 1100 | |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | T | ug/l | 2.4 | | 2.8 | | 2.7 | | 3.1 | | 3.2 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | D | ug/l | 4300 | | 5800 | | 5000 | | 4000 | | 4400 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | T | ug/l | 4400 | | 5700 | | 4600 | | 3800 | | 4500 | |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | D | ug/l | 5 | U | 42 | | 36 | | 29 | | 51 | |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | T | ug/l | 170 | | 140 | | 130 | | 120 | | 140 | |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | D | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | T | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | D | ug/l | 1.5 | | 2.4 | | 2.4 | | 2.5 | | 2.1 | |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | T | ug/l | 2.7 | | 2.9 | | 2.8 | | 3.2 | | 3.2 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | D | ug/l | 3300 | | 3800 | | 3600 | | 3300 | | 3400 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | T | ug/l | 3300 | | 3800 | | 3400 | | 3100 | | 3400 | |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | D | ug/l | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | T | ug/l | 5 | U | 5 | U | 0.86 | J | 5 | U | 0.5 | J |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 0.062 | J | 1 | U |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | D | ug/l | 17000 | | 20000 | | 19000 | | 16000 | | 17000 | |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | T | ug/l | 17000 | | 19000 | | 17000 | | 15000 | | 17000 | |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | D | ug/l | 0.034 | J | 0.19 | J | 0.12 | J | 0.21 | J | 0.068 | J |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | T | ug/l | 0.05 | J | 0.1 | J | 0.073 | J | 0.035 | J | 0.018 | J |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | D | ug/l | 1 | U | 0.14 | J | 0.28 | J | 1 | | 0.21 | J |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | T | ug/l | 1.4 | | 2.4 | | 1.9 | | 2.6 | | 2.5 | |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | D | ug/l | 4.7 | J | 7.6 | J | 6.8 | J | 7.7 | J | 7.9 | J |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | T | ug/l | 8.2 | | 31 | | 9.5 | | 12 | | 12 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | D | ug/l | 56000 | | 68000 | | 60000 | | 50000 | | 54000 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | T | ug/l | 58000 | | 72000 | | 58000 | | 50000 | | 56000 | |
| RA_SW_Other | HEM (Oil and Grease) | 348 | E1664B | N | ug/l | 2100 | J | 1800 | J | | | 2200 | J | | |
| RA_SW_PestPCBs | 4,4'-DDD | 72-54-8 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |

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# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
| | | | | | sys_loc_code | SUW10B | | SUW1B | | SUW2B | | SUW3C | | SUW4B | |
| | | | | | sys_sample_code | SUW10BN | | SUW1BN | | SUW2BN | | SUW3CN | | SUW4BN | |
| | | | | | sample_date | 9/26/2013 | | 9/23/2013 | | 9/23/2013 | | 9/23/2013 | | 9/24/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 7.3 | | 12.8 | | 5.3 | | 5.8 | | 5.7 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_PestPCBs | 4,4'-DDE | 72-55-9 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | 4,4'-DDT | 50-29-3 | SW8081B LL | N | ug/l | 0.0011 | J | 0.0016 | | | | 0.0014 | | | |
| RA_SW_PestPCBs | Aldrin | 309-00-2 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | alpha-BHC | 319-84-6 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Aroclor-1016 | 12674-11-2 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1221 | 11104-28-2 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1232 | 11141-16-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1242 | 53469-21-9 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1248 | 12672-29-6 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1254 | 11097-69-1 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1260 | 11096-82-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1262 | 37324-23-5 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1268 | 11100-14-4 | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | beta-BHC | 319-85-7 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | cis-Chlordane | 5103-71-9 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | delta-BHC | 319-86-8 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Dieldrin | 60-57-1 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Endosulfan I | 959-98-8 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Endosulfan II | 33213-65-9 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Endosulfan Sulfate | 1031-07-8 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Endrin | 72-20-8 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Endrin aldehyde | 7421-93-4 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Endrin ketone | 53494-70-5 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | gamma-BHC (Lindane) | 58-89-9 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Heptachlor | 76-44-8 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Heptachlor Epoxide | 1024-57-3 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_PestPCBs | Methoxychlor | 72-43-5 | SW8081B LL | N | ug/l | 0.0026 | UJ | 0.0025 | U | | | 0.0024 | U | | |
| RA_SW_PestPCBs | PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | PCB, Total Aroclors (Lab provided) | TOT-PCB-ARO | SW8082A LL | N | ug/l | 0.01 | U | 0.01 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Toxaphene | 8001-35-2 | SW8081B LL | N | ug/l | 0.1 | UJ | 0.1 | U | | | 0.095 | U | | |
| RA_SW_PestPCBs | trans-Chlordane | 5103-74-2 | SW8081B LL | N | ug/l | 0.0013 | UJ | 0.0013 | U | | | 0.0012 | U | | |
| RA_SW_SVOCs | 1,1'-Biphenyl | 92-52-4 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 1,2,4,5-Tetrachlorobenzene | 95-94-3 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2,2'-oxybis(1-Chloropropane) | 108-60-1 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |
| RA_SW_SVOCs | 2,3,4,6-Tetrachlorophenol | 58-90-2 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2,4,5-Trichlorophenol | 95-95-4 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2,4,6-Trichlorophenol | 88-06-2 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2,4-Dichlorophenol | 120-83-2 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |
| RA_SW_SVOCs | 2,4-Dimethylphenol | 105-67-9 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2,4-Dinitrophenol | 51-28-5 | SW8270D LL | N | ug/l | 5.3 | U | 5.6 | U | | | 4.8 | U | | |
| RA_SW_SVOCs | 2,4-Dinitrotoluene | 121-14-2 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2,6-Dinitrotoluene | 606-20-2 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2-Chloronaphthalene | 91-58-7 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |

# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW10B | | SUW1B | | SUW2B | | SUW3C | | SUW4B | |
| | | | | | sys_sample_code | SUW10BN | | SUW1BN | | SUW2BN | | SUW3CN | | SUW4BN | |
| | | | | | sample_date | 9/26/2013 | | 9/23/2013 | | 9/23/2013 | | 9/23/2013 | | 9/24/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 7.3 | | 12.8 | | 5.3 | | 5.8 | | 5.7 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | 2-Chlorophenol | 95-57-8 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2-Methylnaphthalene | 91-57-6 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.016 | J | | |
| RA_SW_SVOCs | 2-Methylphenol | 95-48-7 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 2-Nitroaniline | 88-74-4 | SW8270D LL | N | ug/l | 5.3 | U | 5.6 | U | | | 4.8 | U | | |
| RA_SW_SVOCs | 2-Nitrophenol | 88-75-5 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 3-Nitroaniline | 99-09-2 | SW8270D LL | N | ug/l | 5.3 | U | 5.6 | U | | | 4.8 | U | | |
| RA_SW_SVOCs | 4,6-Dinitro-2-methylphenol | 534-52-1 | SW8270D LL | N | ug/l | 5.3 | U | 5.6 | U | | | 4.8 | U | | |
| RA_SW_SVOCs | 4-Bromophenyl-phenylether | 101-55-3 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 4-Chloro-3-methylphenol | 59-50-7 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 4-Chloroaniline | 106-47-8 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 4-Methylphenol | 106-44-5 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | 4-Nitroaniline | 100-01-6 | SW8270D LL | N | ug/l | 5.3 | U | 5.6 | U | | | 4.8 | U | | |
| RA_SW_SVOCs | 4-Nitrophenol | 100-02-7 | SW8270D LL | N | ug/l | 5.3 | U | 5.6 | U | | | 4.8 | U | | |
| RA_SW_SVOCs | Acenaphthene | 83-32-9 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Acenaphthylene | 208-96-8 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Acetophenone | 98-86-2 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Anthracene | 120-12-7 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.018 | J |
| RA_SW_SVOCs | Atrazine | 1912-24-9 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Benzaldehyde | 100-52-7 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | UJ | | | 0.96 | UJ | | |
| RA_SW_SVOCs | Benzo(a)anthracene | 56-55-3 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(a)pyrene | 50-32-8 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(b)fluoranthene | 205-99-2 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(g,h,i)perylene | 191-24-2 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Benzo(k)fluoranthene | 207-08-9 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | bis-(2-chloroethoxy)methane | 111-91-1 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | bis-(2-Chloroethyl)ether | 111-44-4 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |
| RA_SW_SVOCs | bis-(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D LL | N | ug/l | 2.2 | | 1.4 | J | | | 1.9 | U | | |
| RA_SW_SVOCs | Butylbenzylphthalate | 85-68-7 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Caprolactam | 105-60-2 | SW8270D LL | N | ug/l | 5.3 | U | 5.6 | U | | | 4.8 | U | | |
| RA_SW_SVOCs | Carbazole | 86-74-8 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.037 | J | | |
| RA_SW_SVOCs | Chrysene | 218-01-9 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Dibenzo(a,h)anthracene | 53-70-3 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Dibenzofuran | 132-64-9 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Diethylphthalate | 84-66-2 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Dimethylphthalate | 131-11-3 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Di-n-butylphthalate | 84-74-2 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Di-n-octylphthalate | 117-84-0 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Fluoranthene | 206-44-0 | SW8270D LL | N | ug/l | 0.21 | U | 0.032 | J | 0.031 | J | 0.036 | J | 0.035 | J |
| RA_SW_SVOCs | Fluorene | 86-73-7 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Hexachlorobenzene | 118-74-1 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |
| RA_SW_SVOCs | Hexachlorobutadiene | 87-68-3 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |

Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
| | | | | | sys_loc_code | SUW10B | | SUW1B | | SUW2B | | SUW3C | | SUW4B | |
| | | | | | sys_sample_code | SUW10BN | | SUW1BN | | SUW2BN | | SUW3CN | | SUW4BN | |
| | | | | | sample_date | 9/26/2013 | | 9/23/2013 | | 9/23/2013 | | 9/23/2013 | | 9/24/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 7.3 | | 12.8 | | 5.3 | | 5.8 | | 5.7 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | Hexachlorocyclo-pentadiene | 77-47-4 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Hexachloroethane | 67-72-1 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Isophorone | 78-59-1 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Naphthalene | 91-20-3 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Nitrobenzene | 98-95-3 | SW8270D LL | N | ug/l | 2.1 | U | 2.2 | U | | | 1.9 | U | | |
| RA_SW_SVOCs | N-Nitroso-di-n-propylamine | 621-64-7 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |
| RA_SW_SVOCs | N-Nitrosodiphenylamine | 86-30-6 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Pentachlorophenol | 87-86-5 | SW8270D LL | N | ug/l | 1.1 | U | 1.1 | U | | | 0.96 | U | | |
| RA_SW_SVOCs | Phenanthrene | 85-01-8 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.19 | U |
| RA_SW_SVOCs | Phenol | 108-95-2 | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | | | 0.19 | U | | |
| RA_SW_SVOCs | Pyrene | 129-00-0 | SW8270D LL | N | ug/l | 0.21 | U | 0.038 | J | 0.026 | J | 0.034 | J | 0.19 | U |
| RA_SW_SVOCs | Total High-molecular-weight PAHs | TOT-PAH-HMW | SW8270D LL | N | ug/l | 0.21 | U | 0.07 | | 0.057 | | 0.07 | | 0.035 | |
| RA_SW_SVOCs | Total Low-molecular-weight PAHs | TOT-PAH-LMW | SW8270D LL | N | ug/l | 0.21 | U | 0.22 | U | 0.27 | U | 0.19 | U | 0.018 | |
| RA_SW_SVOCs | Total PAHs (sum 16) | TOT-PAH | SW8270D LL | N | ug/l | 0.21 | U | 0.07 | | 0.057 | | 0.07 | | 0.053 | |
| RA_SW_VOCs | 1,1,1-Trichloroethane | 71-55-6 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,1,2,2-Tetrachloroethane | 79-34-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,1,2-Trichloroethane | 79-00-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,1-Dichloroethane | 75-34-3 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,1-Dichloroethene | 75-35-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,2,3-Trichlorobenzene | 87-61-6 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,2,4-Trichlorobenzene | 120-82-1 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,2-Dibromo-3-chloropropane | 96-12-8 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,2-Dibromoethane | 106-93-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,2-Dichlorobenzene | 95-50-1 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,2-Dichloroethane | 107-06-2 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,2-Dichloropropane | 78-87-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,3-Dichlorobenzene | 541-73-1 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,4-Dichlorobenzene | 106-46-7 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | 1,4-Dioxane | 123-91-1 | SW8260B | N | ug/l | 200 | U | 200 | U | | | 200 | U | | |
| RA_SW_VOCs | 2-Butanone | 78-93-3 | SW8260B | N | ug/l | 5 | U | 5 | U | | | 5 | U | | |
| RA_SW_VOCs | 2-Hexanone | 591-78-6 | SW8260B | N | ug/l | 5 | U | 5 | U | | | 5 | U | | |
| RA_SW_VOCs | 4-Methyl-2-pentanone | 108-10-1 | SW8260B | N | ug/l | 5 | U | 5 | U | | | 5 | U | | |
| RA_SW_VOCs | Acetone | 67-64-1 | SW8260B | N | ug/l | 5 | U | 5 | U | | | 5 | U | | |
| RA_SW_VOCs | Benzene | 71-43-2 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Bromochloromethane | 74-97-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Bromodichloromethane | 75-27-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Bromoform | 75-25-2 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Bromomethane | 74-83-9 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Carbon Disulfide | 75-15-0 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Carbon Tetrachloride | 56-23-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Chlorobenzene | 108-90-7 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |

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# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
| | | | | | sys_loc_code | SUW10B | | SUW1B | | SUW2B | | SUW3C | | SUW4B | |
| | | | | | sys_sample_code | SUW10BN | | SUW1BN | | SUW2BN | | SUW3CN | | SUW4BN | |
| | | | | | sample_date | 9/26/2013 | | 9/23/2013 | | 9/23/2013 | | 9/23/2013 | | 9/24/2013 | |
| | | | | | sample_type_code | N | | N | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 7.3 | | 12.8 | | 5.3 | | 5.8 | | 5.7 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_VOCs | Chloroethane | 75-00-3 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Chloroform | 67-66-3 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Chloromethane | 74-87-3 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | cis-1,2-Dichloroethylene | 156-59-2 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | cis-1,3-Dichloropropene | 10061-01-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Cyclohexane | 110-82-7 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Dibromochloromethane | 124-48-1 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Dichlorodifluoromethane | 75-71-8 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Ethylbenzene | 100-41-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Isopropylbenzene | 98-82-8 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | m, p-Xylene | XYLMP | SW8260B | N | ug/l | 2 | U | 2 | U | | | 2 | U | | |
| RA_SW_VOCs | Methyl Acetate | 79-20-9 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Methyl tert-Butyl Ether (MTBE) | 1634-04-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Methylcyclohexane | 108-87-2 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Methylene Chloride | 75-09-2 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | o-Xylene | 95-47-6 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Styrene | 100-42-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Tetrachloroethylene | 127-18-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Toluene | 108-88-3 | SW8260B | N | ug/l | 0.15 | J | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | trans-1,2-Dichloroethene | 156-60-5 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | trans-1,3-Dichloropropene | 10061-02-6 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Trichloroethene | 79-01-6 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Trichlorofluoromethane | 75-69-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Vinyl Chloride | 75-01-4 | SW8260B | N | ug/l | 1 | U | 1 | U | | | 1 | U | | |
| RA_SW_VOCs | Xylenes (total) | 1330-20-7 | SW8260B | N | ug/l | 2 | U | 2 | U | | | 2 | U | | |

# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW5C | | SUW6B | | SUW6B | | SUW7B | | SUW8B | | SUW9C | |
| | | | | | sys_sample_code | SUW5CN | | SUW6BN | | SUW6BR | | SUW7BN | | SUW8BN | | SUW9CN | |
| | | | | | sample_date | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | FD | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 3.6 | | 9.8 | | 9.8 | | 5.6 | | 7.9 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDD | 35822-46-9 | SW8290A | N | ug/l | | | 7.77E-06 | J | 7.51E-06 | J | 6.85E-06 | J | | | | |
| RA_SW_DioxinFurans | 1,2,3,4,6,7,8-HpCDF | 67562-39-4 | SW8290A | N | ug/l | | | 2.28E-06 | J | 1.16E-06 | J | 1.11E-06 | J | | | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8,9-HpCDF | 55673-89-7 | SW8290A | N | ug/l | | | 1.01E-07 | U | 5.64E-08 | U | 6.9E-08 | U | | | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDD | 39227-28-6 | SW8290A | N | ug/l | | | 8.37E-08 | U | 5.59E-07 | J | 7.97E-08 | U | | | | |
| RA_SW_DioxinFurans | 1,2,3,4,7,8-HxCDF | 70648-26-9 | SW8290A | N | ug/l | | | 9.88E-08 | U | 2.58E-07 | U | 6.46E-08 | U | | | | |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDD | 57653-85-7 | SW8290A | N | ug/l | | | 4.29E-07 | J | 7.18E-08 | U | 4.55E-07 | J | | | | |
| RA_SW_DioxinFurans | 1,2,3,6,7,8-HxCDF | 57117-44-9 | SW8290A | N | ug/l | | | 1.19E-06 | J | 5.86E-08 | U | 6.48E-08 | U | | | | |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDD | 19408-74-3 | SW8290A | N | ug/l | | | 2.13E-07 | J | 4.98E-07 | J | 2.24E-07 | J | | | | |
| RA_SW_DioxinFurans | 1,2,3,7,8,9-HxCDF | 72918-21-9 | SW8290A | N | ug/l | | | 1.07E-07 | U | 6.69E-08 | U | 7.33E-08 | U | | | | |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDD | 40321-76-4 | SW8290A | N | ug/l | | | 4.57E-08 | U | 4.26E-08 | U | 5.06E-08 | U | | | | |
| RA_SW_DioxinFurans | 1,2,3,7,8-PeCDF | 57117-41-6 | SW8290A | N | ug/l | | | 7.85E-08 | U | 6.52E-08 | U | 6.09E-08 | U | | | | |
| RA_SW_DioxinFurans | 2,3,4,6,7,8-HxCDF | 60851-34-5 | SW8290A | N | ug/l | | | 9.94E-08 | U | 5.21E-08 | U | 4.18E-07 | J | | | | |
| RA_SW_DioxinFurans | 2,3,4,7,8-PeCDF | 57117-31-4 | SW8290A | N | ug/l | | | 6.92E-07 | J | 5.85E-08 | U | 4.44E-07 | J | | | | |
| RA_SW_DioxinFurans | 2,3,7,8-TCDD | 1746-01-6 | SW8290A | N | ug/l | | | 5.2E-08 | U | 4.06E-08 | U | 7.09E-08 | U | | | | |
| RA_SW_DioxinFurans | 2,3,7,8-TCDF | 51207-31-9 | SW8290A | N | ug/l | | | 7.6E-08 | U | 6.38E-08 | U | 7.24E-08 | U | | | | |
| RA_SW_DioxinFurans | OCDD | 3268-87-9 | SW8290A | N | ug/l | | | 0.000219 | | 0.000218 | | 0.000182 | J | | | | |
| RA_SW_DioxinFurans | OCDF | 39001-02-0 | SW8290A | N | ug/l | | | 1.88E-06 | J | 1.49E-06 | J | 1.67E-06 | J | | | | |
| RA_SW_DioxinFurans | TCDD TEQ Bird | DFTEQ-Bird | SW8290A | N | ug/l | | | 8.89E-07 | | 1.19E-07 | | 5.49E-07 | | | | | |
| RA_SW_DioxinFurans | TCDD TEQ Fish | DFTEQ-Fish | SW8290A | N | ug/l | | | 5.24E-07 | | 3.26E-07 | | 3.07E-07 | | | | | |
| RA_SW_DioxinFurans | TCDD TEQ HH | DFTEQ-HH | SW8290A | N | ug/l | | | 5.58E-07 | | 2.58E-07 | | 3.78E-07 | | | | | |
| RA_SW_DioxinFurans | Total HpCDD | 37871-00-4 | SW8290A | N | ug/l | | | 1.68E-05 | J | 1.56E-05 | J | 1.39E-05 | J | | | | |
| RA_SW_DioxinFurans | Total HpCDF | 38998-75-3 | SW8290A | N | ug/l | | | 3.71E-06 | J | 2.41E-06 | J | 1.84E-06 | J | | | | |
| RA_SW_DioxinFurans | Total HxCDD | 34465-46-8 | SW8290A | N | ug/l | | | 1.9E-06 | J | 3.75E-06 | J | 1.34E-06 | J | | | | |
| RA_SW_DioxinFurans | Total HxCDF | 55684-94-1 | SW8290A | N | ug/l | | | 8.09E-06 | J | 5.36E-06 | J | 5.46E-06 | J | | | | |
| RA_SW_DioxinFurans | Total PeCDD | 36088-22-9 | SW8290A | N | ug/l | | | 3.33E-07 | J | 7.3E-07 | J | 5.06E-08 | U | | | | |
| RA_SW_DioxinFurans | Total PeCDF | 30402-15-4 | SW8290A | N | ug/l | | | 9.7E-06 | J | 8.67E-06 | J | 6.92E-06 | J | | | | |
| RA_SW_DioxinFurans | Total TCDD | 41903-57-5 | SW8290A | N | ug/l | | | 5.2E-08 | U | 1.02E-07 | U | 5.38E-07 | J | | | | |
| RA_SW_DioxinFurans | Total TCDF | 55722-27-5 | SW8290A | N | ug/l | | | 1.57E-05 | J | 1.13E-05 | J | 1.45E-05 | J | | | | |
| RA_SW_DioxinFurans | Total TEQ | TTEQ | SW8290A | N | ug/l | | | 5.58E-07 | | 2.58E-07 | | 3.78E-07 | | | | | |
| RA_SW_Field | Conductivity | Cond | FIELD | T | ms/cm | 0.231 | | 0.242 | | | | 0.247 | | 0.202 | | 0.243 | |
| RA_SW_Field | DO | DO | FIELD | T | mg/l | 3.45 | | 3.46 | | | | 3.41 | | 3.84 | | 3.97 | |
| RA_SW_Field | OXIDATION-REDUCTION POTENTIAL | ORP | FIELD | T | mV | 54.3 | | 63.9 | | | | 7.6 | | 68.7 | | 58.8 | |
| RA_SW_Field | PH | PH | FIELD | T | ph units | 6.86 | | 6.58 | | | | 6.93 | | 6.61 | | 6.52 | |
| RA_SW_Field | SALINITY | SAL | FIELD | T | ppt | 0.11 | | 0.11 | | | | 0.12 | | 0.1 | | 0.12 | |
| RA_SW_Field | TEMPERATURE | TEMP | FIELD | T | deg F | 65.71 | | 67.42 | | | | 67.2 | | 67.93 | | 68.1 | |
| RA_SW_Field | TURBIDITY | TURB | FIELD | T | ntu | 19.4 | | 17.2 | | | | 3.3 | | 8.4 | | 10.7 | |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | D | ug/l | 30 | U | 30 | U | 30 | U | 30 | U | 30 | U | 30 | U |
| RA_SW_Metals | Aluminum | 7429-90-5 | SW6020A | T | ug/l | 490 | | 430 | | 550 | | 230 | | 290 | | 250 | |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | D | ug/l | 0.79 | J | 0.87 | J | 0.88 | J | 0.94 | J | 0.79 | J | 0.77 | J |
| RA_SW_Metals | Antimony | 7440-36-0 | SW6020A | T | ug/l | 0.6 | J | 0.59 | J | 0.81 | J | 0.58 | J | 0.62 | J | 0.54 | J |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | D | ug/l | 1 | U | 0.67 | J | 0.49 | J | 0.64 | J | 0.48 | J | 0.44 | J |
| RA_SW_Metals | Arsenic | 7440-38-2 | SW6020A | T | ug/l | 0.83 | J | 0.48 | J | 1.2 | J | 0.48 | J | 0.82 | J | 0.62 | J |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | D | ug/l | 33 | | 33 | | 32 | | 36 | | 28 | | 34 | |

# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW5C | | SUW6B | | SUW6B | | SUW7B | | SUW8B | | SUW9C | |
| | | | | | sys_sample_code | SUW5CN | | SUW6BN | | SUW6BR | | SUW7BN | | SUW8BN | | SUW9CN | |
| | | | | | sample_date | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | FD | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 3.6 | | 9.8 | | 9.8 | | 5.6 | | 7.9 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_Metals | Barium | 7440-39-3 | SW6020A | T | ug/l | 38 | | 36 | | 37 | | 39 | | 33 | | 38 | |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | D | ug/l | 0.037 | J | 1 | U | 1 | U | 1 | U | 0.042 | J | 0.048 | J |
| RA_SW_Metals | Beryllium | 7440-41-7 | SW6020A | T | ug/l | 0.064 | J | 0.054 | J | 0.056 | J | 0.041 | J | 0.043 | J | 0.083 | J |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Cadmium | 7440-43-9 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | D | ug/l | 16000 | | 16000 | | 16000 | | 18000 | | 14000 | | 17000 | |
| RA_SW_Metals | Calcium | 7440-70-2 | SW6020A | T | ug/l | 16000 | | 16000 | | 15000 | | 18000 | | 14000 | | 17000 | |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | D | ug/l | 1.9 | J | 1.7 | J | 1.8 | J | 1.8 | J | 1.9 | J | 1.6 | J |
| RA_SW_Metals | Chromium | 7440-47-3 | SW6020A | T | ug/l | 3.2 | | 2.9 | | 3.6 | | 2.4 | | 2.8 | | 2.3 | |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | D | ug/l | 0.23 | J | 0.31 | J | 0.34 | J | 0.31 | J | 0.29 | J | 0.1 | J |
| RA_SW_Metals | Cobalt | 7440-48-4 | SW6020A | T | ug/l | 0.97 | | 1 | | 1.1 | | 0.8 | | 0.98 | | 0.89 | |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | D | ug/l | 2.5 | | 2.2 | | 1.9 | J | 1.7 | J | 2.2 | | 1.7 | J |
| RA_SW_Metals | Copper | 7440-50-8 | SW6020A | T | ug/l | 4 | | 4.2 | | 4.2 | | 2.9 | | 4.2 | | 2.9 | |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | D | ug/l | 50 | U | 8.9 | J | 50 | U | 50 | U | 50 | U | 50 | U |
| RA_SW_Metals | Iron | 7439-89-6 | SW6020A | T | ug/l | 1200 | | 1200 | | 1300 | | 740 | | 950 | | 800 | |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Lead | 7439-92-1 | SW6020A | T | ug/l | 2.9 | | 2.9 | | 2.9 | | 2.1 | | 2.6 | | 2.2 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | D | ug/l | 4800 | | 4500 | | 4500 | | 5500 | | 3700 | | 5100 | |
| RA_SW_Metals | Magnesium | 7439-95-4 | SW6020A | T | ug/l | 4900 | | 4500 | | 4500 | | 5400 | | 3900 | | 5100 | |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | D | ug/l | 59 | | 70 | | 75 | | 77 | | 64 | | 5 | U |
| RA_SW_Metals | Manganese | 7439-96-5 | SW6020A | T | ug/l | 140 | | 140 | | 140 | | 140 | | 130 | | 150 | |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | D | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Mercury | 7439-97-6 | SW7470A | T | ug/l | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | D | ug/l | 2.2 | | 2.1 | | 2 | | 2.1 | | 2.1 | | 1.7 | |
| RA_SW_Metals | Nickel | 7440-02-0 | SW6020A | T | ug/l | 2.8 | | 2.8 | | 3 | | 2.4 | | 2.8 | | 2.4 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | D | ug/l | 3500 | | 3400 | | 3500 | | 3700 | | 3100 | | 3500 | |
| RA_SW_Metals | Potassium | 7440-09-7 | SW6020A | T | ug/l | 3500 | | 3400 | | 3300 | | 3600 | | 3200 | | 3500 | |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | D | ug/l | 5 | U | 5 | U | 5 | U | 0.55 | J | 5 | U | 5 | U |
| RA_SW_Metals | Selenium | 7782-49-2 | SW6020A | T | ug/l | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | D | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Silver | 7440-22-4 | SW6020A | T | ug/l | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U | 1 | U |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | D | ug/l | 18000 | | 17000 | | 17000 | | 19000 | | 15000 | | 19000 | |
| RA_SW_Metals | Sodium | 7440-23-5 | SW6020A | T | ug/l | 18000 | | 17000 | | 17000 | | 19000 | | 16000 | | 18000 | |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | D | ug/l | 0.051 | J | 0.047 | J | 0.029 | J | 0.077 | J | 0.028 | J | 0.031 | J |
| RA_SW_Metals | Thallium | 7440-28-0 | SW6020A | T | ug/l | 0.02 | J | 0.018 | J | 0.11 | J | 0.015 | J | 0.053 | J | 0.017 | J |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | D | ug/l | 0.29 | J | 0.61 | J | 0.11 | J | 0.29 | J | 1 | U | 1 | U |
| RA_SW_Metals | Vanadium | 7440-62-2 | SW6020A | T | ug/l | 2.3 | | 2.7 | | 2.7 | | 2 | | 1.6 | | 2.1 | |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | D | ug/l | 6.7 | J | 12 | J | 5.4 | J | 8.3 | J | 12 | J | 4 | J |
| RA_SW_Metals | Zinc | 7440-66-6 | SW6020A | T | ug/l | 9.7 | | 9.8 | | 11 | | 8.4 | | 10 | | 6.9 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | D | ug/l | 58000 | | 56000 | | 56000 | | 64000 | | 48000 | | 62000 | |
| RA_SW_Other | Hardness (as CaCO3) | HARD | A2340C | T | ug/l | 62000 | | 58000 | | 58000 | | 68000 | | 52000 | | 64000 | |
| RA_SW_Other | HEM (Oil and Grease) | 348 | E1664B | N | ug/l | | | 1800 | J | 1500 | J | 1700 | J | | | | |
| RA_SW_PestPCBs | 4,4'-DDD | 72-54-8 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |

# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW5C | | SUW6B | | SUW6B | | SUW7B | | SUW8B | | SUW9C | |
| | | | | | sys_sample_code | SUW5CN | | SUW6BN | | SUW6BR | | SUW7BN | | SUW8BN | | SUW9CN | |
| | | | | | sample_date | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | FD | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 3.6 | | 9.8 | | 9.8 | | 5.6 | | 7.9 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_PestPCBs | 4,4'-DDE | 72-55-9 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | 4,4'-DDT | 50-29-3 | SW8081B LL | N | ug/l | | | 0.0011 | J | 0.0011 | J | 0.0011 | J | | | | |
| RA_SW_PestPCBs | Aldrin | 309-00-2 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | alpha-BHC | 319-84-6 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Aroclor-1016 | 12674-11-2 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1221 | 11104-28-2 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1232 | 11141-16-5 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1242 | 53469-21-9 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1248 | 12672-29-6 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1254 | 11097-69-1 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1260 | 11096-82-5 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1262 | 37324-23-5 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Aroclor-1268 | 11100-14-4 | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | beta-BHC | 319-85-7 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | cis-Chlordane | 5103-71-9 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | delta-BHC | 319-86-8 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Dieldrin | 60-57-1 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Endosulfan I | 959-98-8 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Endosulfan II | 33213-65-9 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Endosulfan Sulfate | 1031-07-8 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Endrin | 72-20-8 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Endrin aldehyde | 7421-93-4 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | UJ | | | | |
| RA_SW_PestPCBs | Endrin ketone | 53494-70-5 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | gamma-BHC (Lindane) | 58-89-9 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Heptachlor | 76-44-8 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Heptachlor Epoxide | 1024-57-3 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_PestPCBs | Methoxychlor | 72-43-5 | SW8081B LL | N | ug/l | | | 0.0026 | UJ | 0.0024 | U | 0.0024 | U | | | | |
| RA_SW_PestPCBs | PCB, Total Aroclors (AECOM Calc) | TOT-PCB-ARO-C | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | PCB, Total Aroclors (Lab provided) | TOT-PCB-ARO | SW8082A LL | N | ug/l | 0.0094 | U | 0.01 | U | 0.0095 | U | 0.0094 | U | 0.0095 | U | 0.0095 | U |
| RA_SW_PestPCBs | Toxaphene | 8001-35-2 | SW8081B LL | N | ug/l | | | 0.1 | UJ | 0.095 | U | 0.094 | U | | | | |
| RA_SW_PestPCBs | trans-Chlordane | 5103-74-2 | SW8081B LL | N | ug/l | | | 0.0013 | UJ | 0.0012 | U | 0.0012 | U | | | | |
| RA_SW_SVOCs | 1,1'-Biphenyl | 92-52-4 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 1,2,4,5-Tetrachlorobenzene | 95-94-3 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2,2'-oxybis(1-Chloropropane) | 108-60-1 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | UJ | | | | |
| RA_SW_SVOCs | 2,3,4,6-Tetrachlorophenol | 58-90-2 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2,4,5-Trichlorophenol | 95-95-4 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2,4,6-Trichlorophenol | 88-06-2 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2,4-Dichlorophenol | 120-83-2 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |
| RA_SW_SVOCs | 2,4-Dimethylphenol | 105-67-9 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2,4-Dinitrophenol | 51-28-5 | SW8270D LL | N | ug/l | | | 4.9 | U | 4.8 | U | 4.8 | U | | | | |
| RA_SW_SVOCs | 2,4-Dinitrotoluene | 121-14-2 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2,6-Dinitrotoluene | 606-20-2 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2-Chloronaphthalene | 91-58-7 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |

# Table 5
Surface Water Analytical Data
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW5C | | SUW6B | | SUW6B | | SUW7B | | SUW8B | | SUW9C | |
| | | | | | sys_sample_code | SUW5CN | | SUW6BN | | SUW6BR | | SUW7BN | | SUW8BN | | SUW9CN | |
| | | | | | sample_date | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | FD | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 3.6 | | 9.8 | | 9.8 | | 5.6 | | 7.9 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | 2-Chlorophenol | 95-57-8 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2-Methylnaphthalene | 91-57-6 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |
| RA_SW_SVOCs | 2-Methylphenol | 95-48-7 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 2-Nitroaniline | 88-74-4 | SW8270D LL | N | ug/l | | | 4.9 | U | 4.8 | U | 4.8 | U | | | | |
| RA_SW_SVOCs | 2-Nitrophenol | 88-75-5 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | | R | | | | |
| RA_SW_SVOCs | 3-Nitroaniline | 99-09-2 | SW8270D LL | N | ug/l | | | 4.9 | U | 4.8 | U | 4.8 | U | | | | |
| RA_SW_SVOCs | 4,6-Dinitro-2-methylphenol | 534-52-1 | SW8270D LL | N | ug/l | | | 4.9 | U | 4.8 | U | 4.8 | U | | | | |
| RA_SW_SVOCs | 4-Bromophenyl-phenylether | 101-55-3 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 4-Chloro-3-methylphenol | 59-50-7 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 4-Chloroaniline | 106-47-8 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 4-Methylphenol | 106-44-5 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | 4-Nitroaniline | 100-01-6 | SW8270D LL | N | ug/l | | | 4.9 | U | 4.8 | U | 4.8 | U | | | | |
| RA_SW_SVOCs | 4-Nitrophenol | 100-02-7 | SW8270D LL | N | ug/l | | | 4.9 | U | 4.8 | U | 4.8 | U | | | | |
| RA_SW_SVOCs | Acenaphthene | 83-32-9 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Acenaphthylene | 208-96-8 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Acetophenone | 98-86-2 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Anthracene | 120-12-7 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Atrazine | 1912-24-9 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Benzaldehyde | 100-52-7 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Benzo(a)anthracene | 56-55-3 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Benzo(a)pyrene | 50-32-8 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Benzo(b)fluoranthene | 205-99-2 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Benzo(g,h,i)perylene | 191-24-2 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Benzo(k)fluoranthene | 207-08-9 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | bis-(2-chloroethoxy)methane | 111-91-1 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | bis-(2-Chloroethyl)ether | 111-44-4 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |
| RA_SW_SVOCs | bis-(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D LL | N | ug/l | | | 2.2 | | 1.9 | U | 1.9 | U | | | | |
| RA_SW_SVOCs | Butylbenzylphthalate | 85-68-7 | SW8270D LL | N | ug/l | | | 0.86 | J | 0.86 | J | 0.96 | U | | | | |
| RA_SW_SVOCs | Caprolactam | 105-60-2 | SW8270D LL | N | ug/l | | | 4.9 | U | 4.8 | U | 4.8 | U | | | | |
| RA_SW_SVOCs | Carbazole | 86-74-8 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |
| RA_SW_SVOCs | Chrysene | 218-01-9 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Dibenzo(a,h)anthracene | 53-70-3 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Dibenzofuran | 132-64-9 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Diethylphthalate | 84-66-2 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Dimethylphthalate | 131-11-3 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Di-n-butylphthalate | 84-74-2 | SW8270D LL | N | ug/l | | | 0.47 | J | 0.51 | J | 0.96 | U | | | | |
| RA_SW_SVOCs | Di-n-octylphthalate | 117-84-0 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Fluoranthene | 206-44-0 | SW8270D LL | N | ug/l | 0.19 | U | 0.017 | J | 0.025 | J | 0.19 | U | 0.019 | J | 0.21 | U |
| RA_SW_SVOCs | Fluorene | 86-73-7 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Hexachlorobenzene | 118-74-1 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |
| RA_SW_SVOCs | Hexachlorobutadiene | 87-68-3 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |

# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | sys_loc_code | SUW5C | | SUW6B | | SUW6B | | SUW7B | | SUW8B | | SUW9C | |
| | | | | | sys_sample_code | SUW5CN | | SUW6BN | | SUW6BR | | SUW7BN | | SUW8BN | | SUW9CN | |
| | | | | | sample_date | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | FD | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 3.6 | | 9.8 | | 9.8 | | 5.6 | | 7.9 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_SVOCs | Hexachlorocyclo-pentadiene | 77-47-4 | SW8270D LL | N | ug/l | | | 0.97 | UJ | 0.96 | UJ | 0.96 | UJ | | | | |
| RA_SW_SVOCs | Hexachloroethane | 67-72-1 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | UJ | | | | |
| RA_SW_SVOCs | Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Isophorone | 78-59-1 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Naphthalene | 91-20-3 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Nitrobenzene | 98-95-3 | SW8270D LL | N | ug/l | | | 1.9 | U | 1.9 | U | 1.9 | U | | | | |
| RA_SW_SVOCs | N-Nitroso-di-n-propylamine | 621-64-7 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |
| RA_SW_SVOCs | N-Nitrosodiphenylamine | 86-30-6 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Pentachlorophenol | 87-86-5 | SW8270D LL | N | ug/l | | | 0.97 | U | 0.96 | U | 0.96 | U | | | | |
| RA_SW_SVOCs | Phenanthrene | 85-01-8 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Phenol | 108-95-2 | SW8270D LL | N | ug/l | | | 0.19 | U | 0.19 | U | 0.19 | U | | | | |
| RA_SW_SVOCs | Pyrene | 129-00-0 | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.021 | J |
| RA_SW_SVOCs | Total High-molecular-weight PAHs | TOT-PAH-HMW | SW8270D LL | N | ug/l | 0.19 | U | 0.017 | | 0.025 | | 0.19 | U | 0.019 | | 0.021 | |
| RA_SW_SVOCs | Total Low-molecular-weight PAHs | TOT-PAH-LMW | SW8270D LL | N | ug/l | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.19 | U | 0.21 | U |
| RA_SW_SVOCs | Total PAHs (sum 16) | TOT-PAH | SW8270D LL | N | ug/l | 0.19 | U | 0.017 | | 0.025 | | 0.19 | U | 0.019 | | 0.021 | |
| RA_SW_VOCs | 1,1,1-Trichloroethane | 71-55-6 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,1,2,2-Tetrachloroethane | 79-34-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,1,2-Trichloroethane | 79-00-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,1-Dichloroethane | 75-34-3 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,1-Dichloroethene | 75-35-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,2,3-Trichlorobenzene | 87-61-6 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,2,4-Trichlorobenzene | 120-82-1 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,2-Dibromo-3-chloropropane | 96-12-8 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,2-Dibromoethane | 106-93-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,2-Dichlorobenzene | 95-50-1 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,2-Dichloroethane | 107-06-2 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,2-Dichloropropane | 78-87-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,3-Dichlorobenzene | 541-73-1 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,4-Dichlorobenzene | 106-46-7 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | 1,4-Dioxane | 123-91-1 | SW8260B | N | ug/l | | | 200 | U | 200 | U | 200 | U | | | | |
| RA_SW_VOCs | 2-Butanone | 78-93-3 | SW8260B | N | ug/l | | | 5 | U | 5 | U | 5 | U | | | | |
| RA_SW_VOCs | 2-Hexanone | 591-78-6 | SW8260B | N | ug/l | | | 5 | U | 5 | U | 5 | U | | | | |
| RA_SW_VOCs | 4-Methyl-2-pentanone | 108-10-1 | SW8260B | N | ug/l | | | 5 | U | 5 | U | 5 | U | | | | |
| RA_SW_VOCs | Acetone | 67-64-1 | SW8260B | N | ug/l | | | 5 | U | 5 | U | 5 | U | | | | |
| RA_SW_VOCs | Benzene | 71-43-2 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Bromochloromethane | 74-97-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Bromodichloromethane | 75-27-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Bromoform | 75-25-2 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Bromomethane | 74-83-9 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Carbon Disulfide | 75-15-0 | SW8260B | N | ug/l | | | 0.4 | J | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Carbon Tetrachloride | 56-23-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Chlorobenzene | 108-90-7 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |

# Table 5
## Surface Water Analytical Data
## Benning Road Facility RI/FS Project
## 3400 Benning Rd, N.E., Washington DC 20019

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | loc_group | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | | RA_Waterside_Area | |
| | | | | | sys_loc_code | SUW5C | | SUW6B | | SUW6B | | SUW7B | | SUW8B | | SUW9C | |
| | | | | | sys_sample_code | SUW5CN | | SUW6BN | | SUW6BR | | SUW7BN | | SUW8BN | | SUW9CN | |
| | | | | | sample_date | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/24/2013 | | 9/25/2013 | |
| | | | | | sample_type_code | N | | N | | FD | | N | | N | | N | |
| | | | | | task_code | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | | Phase2-2013 | |
| | | | | | start_depth | 3.6 | | 9.8 | | 9.8 | | 5.6 | | 7.9 | | 1.8 | |
| | | | | | depth_unit | ft | | ft | | ft | | ft | | ft | | ft | |
| method_analyte_group | chemical_name | cas_rn | analytic_method | fraction | report_result_unit | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers | report_result_value | interpreted_qualifiers |
| RA_SW_VOCs | Chloroethane | 75-00-3 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Chloroform | 67-66-3 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Chloromethane | 74-87-3 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | cis-1,2-Dichloroethylene | 156-59-2 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | cis-1,3-Dichloropropene | 10061-01-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Cyclohexane | 110-82-7 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Dibromochloromethane | 124-48-1 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Dichlorodifluoromethane | 75-71-8 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Ethylbenzene | 100-41-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Isopropylbenzene | 98-82-8 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | m, p-Xylene | XYLMP | SW8260B | N | ug/l | | | 2 | U | 2 | U | 2 | U | | | | |
| RA_SW_VOCs | Methyl Acetate | 79-20-9 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Methyl tert-Butyl Ether (MTBE) | 1634-04-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Methylcyclohexane | 108-87-2 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Methylene Chloride | 75-09-2 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | o-Xylene | 95-47-6 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Styrene | 100-42-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Tetrachloroethylene | 127-18-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Toluene | 108-88-3 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | trans-1,2-Dichloroethene | 156-60-5 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | trans-1,3-Dichloropropene | 10061-02-6 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Trichloroethene | 79-01-6 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Trichlorofluoromethane | 75-69-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Vinyl Chloride | 75-01-4 | SW8260B | N | ug/l | | | 1 | U | 1 | U | 1 | U | | | | |
| RA_SW_VOCs | Xylenes (total) | 1330-20-7 | SW8260B | N | ug/l | | | 2 | U | 2 | U | 2 | U | | | | |

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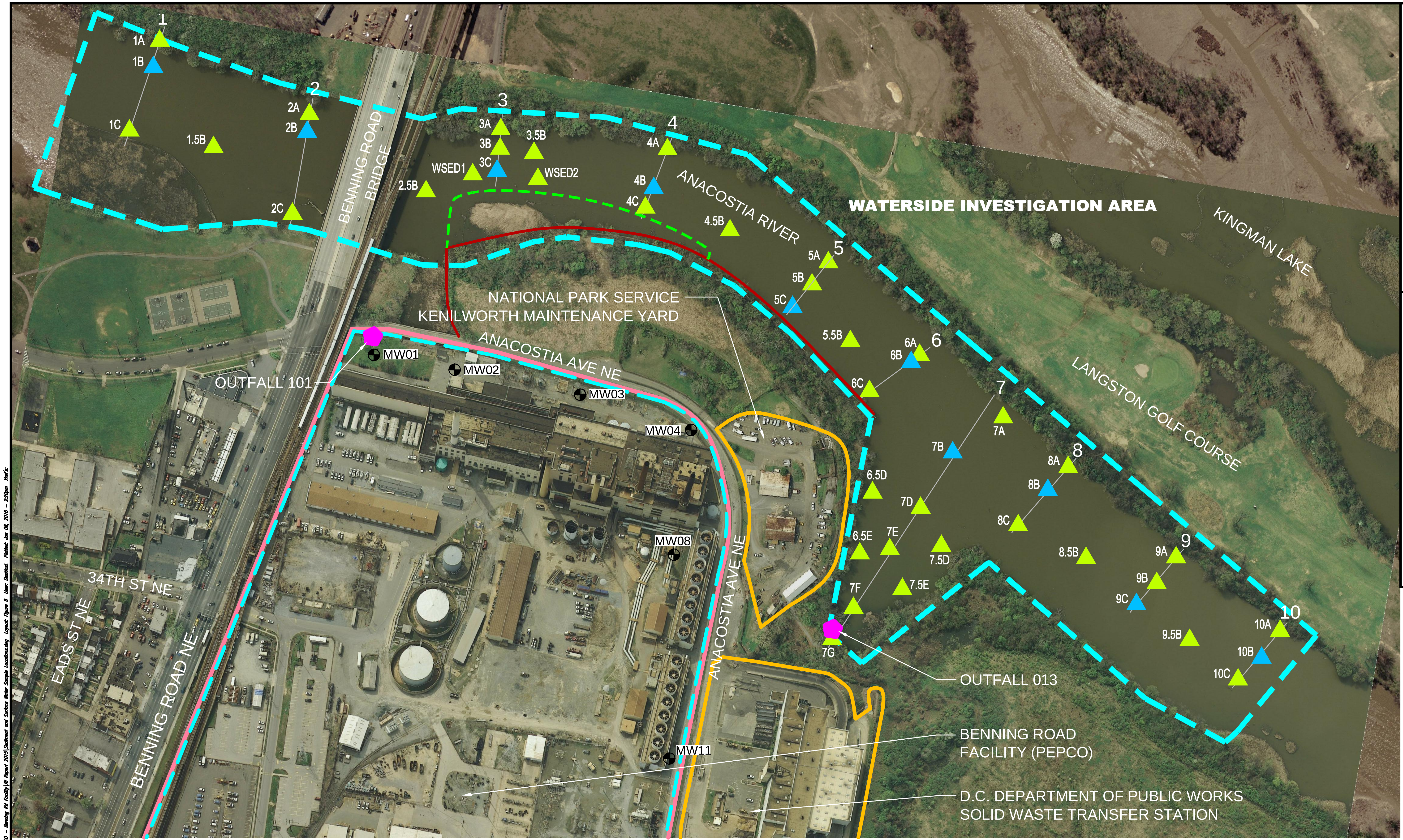
# Figures

**FIGURE 1**

**Sediment, Surface Water, and Groundwater Sampling Locations in Waterside Investigation Area**

Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

DATE: 01/08/2016 | DRAWN BY: LAD | CHECKED BY: RD




LEGEND:

- PROPERTY BOUNDARY
- BENNING ROAD FACILITY PROPERTY BOUNDARY
- INVESTIGATION AREA
- MONITORING WELL LOCATION
- SEDIMENT SAMPLE LOCATION
- CO-LOCATED SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- APPROXIMATE FORMER CONSTRUCTED WETLANDS BOUNDARY
- APPROXIMATE LOCATION OF SEA WALL

0 125 250 500
SCALE IN FEET

AECOM

# Attachment E

# Calculation of the Groundwater DAF

Groundwater discharge from MW-1 upper aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Elevation of top of silt-clay layer

-21.36 ft MLLW

Elevation of water table (low tide)

3.24 ft MLLW

Saturated thickness (h) of unconfined aquifer

24.6 ft

Width of boundary segment through which GW flows (l)

235 ft (distance from property boundary to halfway between MW-1 and MW-2, from Google Earth)

A= 5781 square ft

Calculation of K:

Average of K from slug tests:

MW-1A

0.00002596 ft/sec
0.00002817 ft/sec
0.00002737 ft/sec
0.0000275 ft/sec
0.00002781 ft/sec

K= 2.7362E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-1, MW-2, and MW-5

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-1A | 1323686.71 | 448230.77 | 3.24 |
| MW-2A | 1323684.71 | 448456.98 | 4 |
| MW-5A | 1324032.04 | 448172.22 | 6.6 |

I= 0.011 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00173998 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 0.00012518

Groundwater discharge from MW-1 lower aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Thickness of lower aquifer (h)

| Top of LWZ (ft bgs) | Bottom of LWZ (ft bgs) | Thickness |
|---|---|---|
| 39 | 52 | 13 |

Width of boundary segment through which GW flows (l)

235 ft (distance from property boundary to halfway between MW-1 and MW-2, from Google Earth)

A= 3055 square ft

Calculation of K:

Average of K from slug tests:

MW-1B

0.00005158 ft/sec
0.00005409 ft/sec
0.00005568 ft/sec
0.00005965 ft/sec
0.00007115 ft/sec
0.00005471 ft/sec

K= 0.00005781 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-1, MW-2, and MW-5

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-1B | 1323686.71 | 448230.768 | 3.27 |
| MW-2B | 1323684.71 | 448456.975 | 3.54 |
| MW-5B | 1324032.04 | 448172.221 | 4.43 |

I= 0.004 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00070644 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 5.0823E-05

Groundwater discharge from MW-2 upper aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Elevation of top of silt-clay layer

-14.72 ft MLLW

Elevation of water table (low tide)

4 ft MLLW

Saturated thickness (h) of unconfined aquifer

18.72 ft

Width of boundary segment through which GW flows (l)

290 ft (distance from midpoint of MW-1 and MW-2 to midpoint of MW-2 and MW-3, from Google Earth)

A= 5428.8 square ft

Calculation of K:

Average of K from slug tests at 3 wells in the western portion of the site:

| | MW-1A | MW-3A | MW-6A | |
|---|---|---|---|---|
| | 0.00002596 | 8.022E-05 | 0.0000173 | ft/sec |
| | 0.00002817 | 0.0000565 | 2.399E-05 | ft/sec |
| | 0.00002737 | 5.023E-05 | 2.221E-05 | ft/sec |
| | 0.0000275 | 5.748E-05 | 2.251E-05 | ft/sec |
| | 0.00002781 | 4.915E-05 | 2.131E-05 | ft/sec |
| | | 5.104E-05 | 1.976E-05 | ft/sec |
| average | 2.7362E-05 | 5.744E-05 | 2.118E-05 | ft/sec |

K= 3.2168E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-2, MW-3, and MW-6

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-2A | 1323684.71 | 448456.98 | 4 |
| MW-3A | 1323686.31 | 448809.39 | 5.4 |
| MW-6A | 1324211.25 | 448553.86 | 5.8 |

I= 0.005 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00087316 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application
(http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 6.2817E-05

Groundwater discharge from MW-2 lower aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Thickness of lower aquifer (h)

| Top of LWZ (ft bgs) | Bottom of LWZ (ft bgs) | Thickness |
|---|---|---|
| 35 | 53 | 18 |

Width of boundary segment through which GW flows (l)

290 ft (distance from midpoint of MW-1 and MW-2 to midpoint of MW-2 and MW-3, from Google

A= 5220 square ft

Calculation of K:

Average of K from slug tests at 3 wells in the western portion of the site:

| | MW-1B | MW-3B | MW-6B | |
|---|---|---|---|---|
| | 0.00005158 | 0.00008006 | 0.0000268 | ft/sec |
| | 0.00005409 | 0.00007025 | 0.00001901 | ft/sec |
| | 0.00005568 | 0.00007011 | 0.00002869 | ft/sec |
| | 0.00005965 | 0.00005106 | 0.00002498 | ft/sec |
| | 0.00007115 | 0.00009747 | 0.00002324 | ft/sec |
| | 0.00005471 | 0.0000648 | 0.00001652 | ft/sec |
| average | 0.00005781 | 7.2292E-05 | 2.3207E-05 | ft/sec |

K= 4.5945E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-1, MW-2, and MW-5

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-2B | 1323684.71 | 448456.975 | 3.54 |
| MW-3B | 1323686.31 | 448809.394 | 4.5 |
| MW-6B | 1324211.25 | 448553.855 | 6.0 |

I= 0.005 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00150884 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 0.00010855

Attachment E
Calculation of Groundwater DAF
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Groundwater discharge from MW-3 upper aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Elevation of top of silt-clay layer
-8.42 ft MLLW

Elevation of water table (low tide)
5.4 ft MLLW

Saturated thickness (h) of unconfined aquifer
13.82 ft

Width of boundary segment through which GW flows (l)
330 ft (distance from midpoint of MW-2 and MW-3 to midpoint of MW-3 and MW-4, from Google

A= 4560.6 square ft

Calculation of K:

Average of K from slug tests:

MW-3A
8.022E-05 ft/sec
0.0000565 ft/sec
5.023E-05 ft/sec
5.748E-05 ft/sec
4.915E-05 ft/sec
5.104E-05 ft/sec

K= 5.872E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-3, MW-4, and MW-8

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-3A | 1323686.3 | 448809.39 | 5.4 |
| MW-4A | 1323752.9 | 449113.68 | 5.55 |
| MW-8A | 1324070.2 | 449146.9 | 5.7 |

I= 0.0006 ft/ft (calculated graphically by 3-point problem method)

Q= 0.000160668 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application
(http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 1.15589E-05

Groundwater discharge from MW-3 lower aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Thickness of lower aquifer (h)

| Top of LWZ (ft bgs) | Bottom of LWZ (ft bgs) | Thickness |
|---|---|---|
| 40 | 50 | 10 |

Width of boundary segment through which GW flows (l)

330 ft (distance from property boundary to halfway between MW-1 and MW-2, from Google Earth)

A= 3300 square ft

Calculation of K:

Average of K from slug tests:

MW-3B
0.00008006 ft/sec
0.00007025 ft/sec
0.00007011 ft/sec
0.00005106 ft/sec
0.00009747 ft/sec
0.0000648 ft/sec

K= 7.2292E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-3, MW-4, and MW-7

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-3B | 1323686.31 | 448809.394 | 4.5 |
| MW-4B | 1323752.88 | 449113.68 | 4.66 |
| MW-7B | 1324287.51 | 448860.381 | 7.2 |

I= 0.005 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00119281 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 8.5814E-05

Groundwater discharge from MW-4 upper aquifer to the Anacostia (Q) = KIA
Calculation of A (lxh):

Elevation of top of silt-clay layer
-9.95 ft MLLW

Elevation of water table (low tide)
5.55 ft MLLW

Saturated thickness (h) of unconfined aquifer
15.5 ft

Width of boundary segment through which GW flows (l)
250 ft (distance from midpoint of MW-3 and MW-4 to midpoint of MW-4 and MW-8, from Google Earth)

A= 3875 square ft

Calculation of K:

Average of K from slug tests at 3 wells in the western portion of the site:

| | MW-1A | MW-3A | MW-6A | |
|---|---|---|---|---|
| | 2.596E-05 | 8.022E-05 | 0.0000173 | ft/sec |
| | 2.817E-05 | 0.0000565 | 2.399E-05 | ft/sec |
| | 2.737E-05 | 5.023E-05 | 2.221E-05 | ft/sec |
| | 0.0000275 | 5.748E-05 | 2.251E-05 | ft/sec |
| | 2.781E-05 | 4.915E-05 | 2.131E-05 | ft/sec |
| | | 5.104E-05 | 1.976E-05 | ft/sec |
| average | 2.736E-05 | 5.744E-05 | 2.118E-05 | ft/sec |

K= 3.217E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-4, MW-6, and MW-8

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-4A | 1323752.9 | 449113.68 | 5.55 |
| MW-6A | 1324211.3 | 448553.86 | 5.8 |
| MW-8A | 1324070.2 | 449146.9 | 5.7 |

I= 0.0005 ft/ft (calculated graphically by 3-point problem method)

Q= 5.3014E-05 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 3.8139E-06

Groundwater discharge from MW-4 lower aquifer to the Anacostia (Q) = KIA
Calculation of A (lxh):

Thickness of lower aquifer (h)

| Top of LWZ (ft bgs) | Bottom of LWZ (ft bgs) | Thickness |
|---|---|---|
| 35 | 45 | 10 |

Width of boundary segment through which GW flows (l)

250 ft (distance from midpoint of MW-3 and MW-4 to midpoint of MW-4 and MW-8, from Google

A= 2500 square ft

Calculation of K:

Average of K from slug tests at 3 wells in the western portion of the site:

| | MW-1B | MW-3B | MW-6B | |
|---|---|---|---|---|
| | 0.00005158 | 0.00008006 | 0.0000268 | ft/sec |
| | 0.00005409 | 0.00007025 | 0.00001901 | ft/sec |
| | 0.00005568 | 0.00007011 | 0.00002869 | ft/sec |
| | 0.00005965 | 0.00005106 | 0.00002498 | ft/sec |
| | 0.00007115 | 0.00009747 | 0.00002324 | ft/sec |
| | 0.00005471 | 0.0000648 | 0.00001652 | ft/sec |
| average | 0.00005781 | 7.2292E-05 | 2.3207E-05 | ft/sec |

K= 4.5945E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-4, MW-6, and MW-7

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-4B | 1323752.88 | 449113.68 | 4.66 |
| MW-6B | 1324211.25 | 448553.855 | 6 |
| MW-7B | 1324287.51 | 448860.381 | 7.2 |

I= 0.004 ft/ft (calculated graphically by 3-point problem method)

Q= 0.0005781 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application
(http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 4.15899E-05

Groundwater discharge from MW-8 upper aquifer to the Anacostia (Q) = KIA
Calculation of A (lxh):

Elevation of top of silt-clay layer
-6.4 ft MLLW

Elevation of water table (low tide)
5.7 ft MLLW

Saturated thickness (h) of unconfined aquifer
12.1 ft

Width of boundary segment through which GW flows (l)
440 ft (distance from midpoint of MW-4 and MW-8 to midpoint of MW-8 and MW-11, from Google Earth)

A= 5324 square ft

Calculation of K:

Average of K from slug tests at 3 wells in the northwest portion of the site:

| | MW-3A | MW-6A | MW-11A | |
|---|---|---|---|---|
| | 8.022E-05 | 0.0000173 | 1.376E-05 | ft/sec |
| | 0.0000565 | 2.399E-05 | 1.278E-05 | ft/sec |
| | 5.023E-05 | 2.221E-05 | 2.109E-05 | ft/sec |
| | 5.748E-05 | 2.251E-05 | 1.388E-05 | ft/sec |
| | 4.915E-05 | 2.131E-05 | 1.903E-05 | ft/sec |
| | 5.104E-05 | 1.976E-05 | 1.377E-05 | ft/sec |
| average | 5.872E-05 | 2.118E-05 | 1.572E-05 | ft/sec |

K= 2.694E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-8, MW-7, and MW-11

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-8A | 1324070.2 | 449146.9 | 5.7 |
| MW-7A | 1324287.5 | 448860.38 | 7.3 |
| MW-11A | 1324624.3 | 449241.15 | 6.1 |

I= 0.0047 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00146924 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 0.0001057

Groundwater discharge from MW-8 lower aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Thickness of lower aquifer (h)

| Top of LWZ (ft bgs) | Bottom of LWZ (ft bgs) | Thickness |
|---|---|---|
| 50 | 60 | 10 |

Width of boundary segment through which GW flows (l)

440 ft (distance from midpoint of MW-4 and MW-8 to midpoint of MW-8 and MW-11, from Google Earth)

A= 4400 square ft

Calculation of K:

Average of K from slug tests at 3 wells in the northwest portion of the site:

| | MW-3A | MW-6A | MW-11A | |
|---|---|---|---|---|
| | 0.00008022 | 0.0000173 | 0.00001376 | ft/sec |
| | 0.0000565 | 0.00002399 | 0.00001278 | ft/sec |
| | 0.00005023 | 0.00002221 | 0.00002109 | ft/sec |
| | 0.00005748 | 0.00002251 | 0.00001388 | ft/sec |
| | 0.00004915 | 0.00002131 | 0.00001903 | ft/sec |
| | 0.00005104 | 0.00001976 | 0.00001377 | ft/sec |
| average | 5.7437E-05 | 0.00002118 | 1.5718E-05 | ft/sec |

K= 2.6741E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-8, MW-7, and MW-11

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-8B | 1324070.24 | 449146.902 | 4.2 |
| MW-7B | 1324287.51 | 448860.381 | 7.2 |
| MW-11B | 1324624.32 | 449241.152 | 4.6 |

I= 0.009 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00227449 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 0.00016363

Groundwater discharge from MW-11 upper aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Elevation of top of silt-clay layer
-23.5 ft MLLW

Elevation of water table (low tide)
6.1 ft MLLW

Saturated thickness (h) of unconfined aquifer
29.6 ft

Width of boundary segment through which GW flows (l)
500 ft (distance from midpoint of MW-8 and MW-1 to site boundary, from Google Earth)

A= 14800 square ft

Calculation of K:

Average of K from slug tests:

MW-11A
1.376E-05 ft/sec
1.278E-05 ft/sec
2.109E-05 ft/sec
1.388E-05 ft/sec
1.903E-05 ft/sec
1.377E-05 ft/sec

K= 1.572E-05 ft/sec

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-11, MW-7, and MW-10

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-11A | 1324624.3 | 449241.15 | 6.1 |
| MW-7A | 1324287.5 | 448860.38 | 7.3 |
| MW-10A | 1324574 | 448707.16 | 10.8 |

I= 0.0120 ft/ft (calculated graphically by 3-point problem method)

Q= 0.00279158 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application
(http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 0.00020083

Groundwater discharge from MW-11 lower aquifer to the Anacostia (Q) = KIA

Calculation of A (lxh):

Thickness of lower aquifer (h)

| Top of LWZ (ft bgs) | Bottom of LWZ (ft bgs) | Thickness |
|---|---|---|
| 50 | 61.8 | 11.8 |

Width of boundary segment through which GW flows (l)

500 ft (distance from property boundary to halfway between MW-1 and MW-2, from Google Earth)

A= 5900 square ft

Calculation of K:

Average of K from slug tests:

| MW-11B | |
|---|---|
| 3.333E-05 | ft/sec |
| 2.153E-05 | ft/sec |
| 2.161E-05 | ft/sec |
| 2.016E-05 | ft/sec |
| 0.0000233 | ft/sec |
| 2.235E-05 | ft/sec |
| K= 2.371E-05 | ft/sec |

Calculation of I (dh/dL):

dh/dl = slope of the plane formed by gw level at MW-11, MW-7, and MW-10

| | x (easting) | y (northing) | z (water level, ft MLLW) |
|---|---|---|---|
| MW-11B | 1324624.3 | 449241.152 | 4.6 |
| MW-7B | 1324287.5 | 448860.381 | 7.2 |
| MW-10B | 1324574 | 448707.159 | 10.3 |

I= 0.012 ft/ft (calculated graphically by 3-point problem method)

Q= 0.001678904 cu.ft./sec

7Q10 Anacostia streamflow 13.9 cu.ft./sec

7Q10 estimated by USGS Maryland StreamStats application (http://water.usgs.gov/osw/streamstats/maryland.html)

DAF= 0.000120784