

October 24, 2006  
10077.012

Oregon Department of Environmental Quality  
Northwest Region  
2020 SW Fourth Avenue  
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Portland, Oregon 97201-4987

**VIA Email**

**Attention: Anna Coates**

**Subject: Draft Level III Ecological Risk Assessment  
Remedial Investigation/Feasibility Study/Interim Removal Action Measures  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon  
DEQ ECSI File #2277**

Dear Ms. Coates:

Enclosed are four copies of the above-referenced report. This report is being submitted to you on behalf of the Astoria Area-Wide Cooperating Parties group and is intended to comply with the terms of DEQ Order No. ECSR-NWR-01-11.

Please call me at (503)768-5121 if you have any questions or comments regarding this report.

Sincerely,  
***EnviroLogic Resources, Inc.***



Thomas J. Calabrese, RG, CWRE  
Principal Hydrogeologist  
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Ms. Anna Coates  
October 24, 2006  
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### Level III Ecological Risk Assessment Report Astoria Area-Wide Petroleum Site

16 October 2006

Prepared for  
Astoria Area-Wide Potentially  
Responsible Party (PRP) Group

K/J Project No. 0592004.00

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## Section 1: Introduction and Background

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Kennedy/Jenks Consultants prepared this Level III baseline ecological risk assessment (ERA) report on behalf of the Astoria Area-Wide Potentially Responsible Party (PRP) Group for the Astoria Area-Wide Petroleum Site (Site) located in Astoria, Oregon. The purpose of the ERA is to evaluate the potential for adverse impacts to the environment attributable to exposure to Site-related petroleum constituents. Per the Kennedy/Jenks (2005) work plan, the assessment endpoints evaluated in this ERA included the following:

- Protection of resident pelagic organisms (e.g., sculpin, stickleback, perch) from reproductive impairment caused by Site constituents
- Protection of the benthic invertebrate community from reproductive impairment caused by Site constituents.

Kennedy/Jenks conducted the Level III ERA in accordance with the Oregon Department of Environmental Quality (DEQ) approved 22 September 2005 ERA work plan (Kennedy/Jenks 2005). The results of this risk assessment will be used by the PRP Group to assist in the selection and design of a final remedy for this Site, as applicable.

The Level III ERA was completed as part of the remedial investigation/feasibility study (RI/FS) being performed pursuant to a Unilateral Order issued in December 2001 by the DEQ (No. ECSR-NWR-01-11).

### 1.1 Site Location and Study Area

The Site is located in the SW quarter of Section 7, Township 8 North, Range 9 West; the SE quarter of Section 12, Township 8 North, Range 10 West; and the NE quarter of Section 13, Township 8 North, Range 10 West of the Willamette Meridian. The Site location, relative to surrounding physical features, is shown on Figure 1.

Per DEQ ERA guidance, a Level I ERA was completed in August 2004 (Hart Crowser 2004a). The study area for the Level I ERA was previously described as bounded on the north by Slip 2 (approximately 600 feet from the shore toward the Columbia River), on the east by Portway Street, on the south by West Marine Drive, and on the west by the western property boundary of the former McCall Oil Bulk Plant (Chevron) property. The ERA study area encompasses a portion of the Columbia River within Slip 2 at the Port of Astoria, as well as the upland area as bounded above. The ongoing interim remedial action measure (IRAM) consists of a floating boom and free product absorbent system to contain petroleum hydrocarbons presently seeping into the Columbia River from the filled shoreline at the head of Slip 2. Further upland investigations are also underway to address the source(s) of the seep.

On 20 August 2004, DEQ issued its finding in agreement with the Level I ERA that no ecologically important species and/or habitats were present in the upland portion of the Site but was not prepared to “discount the near-water and in-water portions of the site as ‘low quality habitat’” (DEQ 2004). Also, a preliminary Level II screening of sediment samples collected from

the southeast corner of Slip 2 was conducted in November 2003 (EnviroLogic Resources 2003). The Level II screening identified several polynuclear aromatic hydrocarbons (PAHs) that exceeded their respective DEQ marine sediment screening level values (SLVs).

This Level III ERA addresses only the in-water portion of the Site within the southern half of Slip 2 – in particular, the area within and outside of the boom in the southeast corner of the Slip 2.

## 1.2 Ecological Setting

The Site is located on the Lower Columbia River estuary. Tides at the mouth of the Columbia River exhibit the diurnal inequality that is typical along the Pacific Coast. Average diurnal range of tides is approximately 8.6 feet, with the extreme tidal variation as high as 12 feet (Percy et al. 1974). In the Columbia River, tidal impacts in water level have been observed as far upstream as Bonneville Dam (river mile [RM] 146) during low flow, reversal of river flow has been measured as far upstream as Oak Point (RM 53), and intrusion of salt water is typically to Harrington Point (RM 23) (LCFRB 2004).

The Lower Columbia River estuary experiences a turbidity maximum, which is an area within which concentrations of suspended sediment are substantially higher than either downstream toward the mouth of the estuary or upstream in the river. This is the result of a net circulation pattern in which dense saline water flows landward in the bottom layers and less dense fresher water flows seaward in the surface layers (Percy et al. 1974). The lowest river flows generally occur during September and October, when rainfall and snowmelt runoff are low. The highest flows occur from April to June, resulting from snowmelt runoff. High flows also occur between November and March, caused by heavy winter precipitation. The discharge at the mouth of the river ranges from 100,000 to 500,000 cubic feet per second (cfs), with an average of about 260,000 cfs (LCFRB 2004).

The Port of Astoria is a developed area encompassing the northwest corner of downtown Astoria. Slip 2 (Figure 1) is located south of the Columbia River and is armored with riprap, wooden bulkheads, and sheetpiling around the pier faces. Dock ruins and historic wooden pilings were observed in the water just offshore of the piers. An Oregon Responder Barge and associated tug are moored on the east side of Slip 2. In the mid-1980s, there was a fire on Pier 2 adjacent to the hydrocarbon seep. The fire damage is still evident from numerous burned or charred pilings and timbers. The slips at the Port of Astoria are dredged on an annual basis, which causes annual disturbance of the benthic community that may be present in the slip. A mudflat in the southwest corner of Slip 2 is exposed during low tide (Figure 2), with cattails and rushes the emergent vegetation growing out of the mudflat. This area in the southwest corner of Slip 2 was actively dredged until relatively recently, when the area came to be used for transshipment of dredged spoils in preparation for discharge to the flow lane (Hart Crowser 2004b). The area within the current containment boom in Slip 2 is also exposed as a mudflat under low tide conditions. In general, Slip 2 provides poor quality habitat for aquatic and benthic organisms and does not resemble the “natural” habitat found at a relatively undisturbed reference site (Hart Crowser 2004b).

## Section 2: Sediment and Surface Water Investigation

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Kennedy/Jenks Consultants conducted a surface sediment and surface water investigation at the Site on 26 January 2006. Divers from Northwest Underwater Construction (NWUC) of Vancouver, Washington, collected sediment samples and provided the sampling vessel for the investigation. Kennedy/Jenks personnel collected mid-water column samples from the NWUC sampling vessel. Station positioning, sampling methods, sample handling and custody, decontamination procedures, laboratory chemical and biological analyses, and field documentation were performed in a manner consistent with the Kennedy/Jenks (2005) ERA work plan. Any deviations from the DEQ-approved work plan are noted below. Photographs were taken to document site conditions and are presented in Appendix A. Field log data sheets were completed to describe each sediment sample and are presented in Appendix B.

### 2.1 Station Location

Kennedy/Jenks personnel used a handheld global positioning system (GPS) Garmin GPSMAP 76S with a stated accuracy of  $\pm 3$  meters to obtain latitude/longitude coordinates for the seven sediment sampling stations (five Site and two reference) and five surface water sampling stations outlined in the Kennedy/Jenks (2005) work plan. Surface water samples SW-100, SW-101, SW-102, and SW-104 were collected from co-located stations with sediment samples SD-100, SD-101, SD-102, and SD-104, per the work plan (Figure 2). Table 1 summarizes the sampling station coordinates, approximate depth to mudline, approximate tidal height, and corrected depth to mudline (tide corrected to Columbia River Datum [CRD]).

### 2.2 Sampling Methods and Documentation

#### 2.2.1 Surface Water Sampling

At each surface water sampling station, an approximate depth sounding was first obtained with a graduated lead line. One change from the ERA work plan was the use of a surface-deployed water column sampler, as opposed to the proposed diver collection method of water samples. Furthermore, the water column samples were collected at each co-located station prior to collection of surface sediment samples. These procedures ensured minimal disturbance of the sediment bottom and undesirable turbidity in the water column samples that could potentially bias chemical analyses.

Kennedy/Jenks staff deployed a 2.2-liter capacity Van Dorn horizontal water sampler to the midpoint of the water column. A weighted messenger was released to trigger water sample capture at the appropriate depth. Upon retrieval of the sampler, surface water samples were placed directly into precleaned laboratory containers, labeled, and placed into coolers with ice for transportation to Columbia Analytical Services (CAS), Kelso, Washington. Chain-of-custody procedures were followed as stated in the work plan during the course of sampling and analysis. The Van Dorn sampler was decontaminated in between stations by thoroughly scrubbing the unit with a soap and water solution, followed by a distilled water rinse.

### 2.2.2 Sediment Sampling

Upon arriving at the sediment sampling station (or following the collection of surface water samples at co-located stations), a NWUC diver was deployed. The diver descended to the mudline and noted any visual observations. The diver collected the upper 10 cm of sediment from below the mudline using a handheld core tube. Both ends of the tube were then capped to prevent loss of material. Upon returning to the surface, the sediment was emptied into a stainless steel container. Multiple cores were collected at each sampling station to obtain the required sediment volumes for both chemical and biological testing.

At each sampling station, the collected sediment was thoroughly homogenized by hand using a stainless steel spoon. Samples were placed into precleaned laboratory containers, labeled, and placed into coolers with ice for transportation to CAS. Chain-of-custody procedures were followed as stated in the work plan during the course of sampling and analysis.

Decontamination of core tubes, stainless steel spoons, and the stainless steel container was accomplished in between stations by thoroughly scrubbing the equipment with a soap and water solution, followed by a distilled water rinse.

Petroleum odors were noted during the collection of several of the surface sediment samples. These samples were located in the southeast corner of Slip 2, and consisted of samples SD-100, SD-101, SD-102, and SD-103 (Figure 2).

## Section 3: Physical and Chemical Results

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### 3.1 Surface Water Chemical Analytical Results

Surface water chemical analytical results are presented on Table 2 and compared to EPA ambient water quality criteria (AWQC) final chronic values (FCVs) for chronic toxicity of individual PAHs in water exposures (EPA 2003). Because no AWQC are available for benzene, toluene, ethylbenzene, and xylene (BTEX), surface water concentrations for these chemicals were compared to DEQ aquatic SLVs (Table 4). The objective of the surface water sampling and evaluation program was to evaluate whether petroleum constituents in the seep or sheen observed in Slip 2 may pose an ecological risk to pelagic (water column) aquatic receptors. No exceedances of any FCVs or SLVs were observed for all surface water samples analyzed. Therefore, chemical constituents in the water column at the Site pose no risk to aquatic ecological receptors.

### 3.2 Sediment Physical Characteristics

All seven surface sediment samples were analyzed for the full list of Washington State Sediment Management Standards (SMS) chemicals and six conventional parameters. Sediment grain size, total organic carbon (TOC), total solids, total volatile solids (TVS), ammonia, and total sulfides are summarized on Table 3. A summary of the laboratory chemical analytical results compared to DEQ (2001) marine/estuarine sediment SLVs is presented on Table 4. The complete laboratory analytical report is included as Appendix C.

Sediment samples collected at the site were predominantly silt and clay grain sizes (Table 2). All sediment samples, including the two reference samples, contained at least 68 percent fine grained particles, with the exception of SD-102 (50.5 percent silt/clay). Levels of TOC and TVS were highest in SD-102. Ammonia as nitrogen, total solids, and total sulfide were lowest in SD-102. No other anomalies were observed in the sediment physical data.

### 3.3 Sediment Chemical Analytical Results

Sediment chemical analytical results are summarized on Table 4. Several sediment samples contained levels of multiple analytes exceeding DEQ marine/estuarine sediment SLVs. All samples collected had exceedances of SLVs for copper, likely due to high naturally occurring background concentrations in sediments. Reference samples REF-EBB and REF-YB and test sample SD-104 had slight exceedances of the DEQ SLV for mercury, with enrichment ratios less than two. Enrichment ratio is calculated by dividing the chemical concentration by the appropriate SLV for that chemical. Samples SD-101 and SD-102 had exceedances of the DEQ SLV for zinc.

Concentrations of specific petroleum constituents in samples SD-100, SD-101, and SD-102 were sufficiently high to warrant dilution by CAS prior to analysis; these analytes are flagged with a "D" and the dilution factor stated in the footnotes (Table 4). Exceedances of DEQ SLVs for the light PAHs (LPAHs) naphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene,



fluorene, phenanthrene, and anthracene were observed in samples SD-101, SD-102 and SD-103. Exceedances of DEQ SLVs for the heavy PAHs (HPAHs) fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(a)pyrene, and dibenz(a,h)anthracene were observed in samples SD-100, SD-101, SD-102, and SD-103. Exceedances of DEQ SLVs for total LPAHs and total PAHs were also observed in samples SD-101, SD-102, and SD-103. Exceedance of the DEQ SLV for total HPAHs was observed in samples SD-100, SD-101, SD-102, and SD-103.

Concentrations of total polychlorinated biphenyls (PCBs) (the sum of the detected Aroclors 1248, 1254, 1260) in samples SD-100, SD-101, and SD-102 also exceeded the DEQ marine/estuarine sediment SLV.

The reporting limits for several analytes were elevated in samples SD-100, SD-101, and SD-102. The sample extracts were diluted by a factor of 100 prior to analysis because of relatively high levels of target (i.e., petroleum) analyte concentrations. Because of the dilution in samples SD-100, SD-101, and SD-102, the reporting limits for 13 compounds exceeded their respective SLVs despite yielding non-detect results: acenaphthylene; acenaphthene; fluorene; anthracene, hexachlorobenzene; dimethyl phthalate; diethyl phthalate; di-n-butyl phthalate; dibenzofuran; hexachlorobutadiene; N-nitroso-diphenylamine; pentachlorophenol; benzoic acid. These are false exceedances of the SLVs based on the high levels of specific petroleum constituents identified on Table 4.

## Section 4: Biological Testing

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As part of the Level III baseline ERA, bioassay testing was completed on the five surface sediment samples from Slip 2 and both reference surface sediment samples. Northwestern Aquatic Sciences (NAS) of Newport, Oregon conducted the sediment bioassay tests. The suite of proposed marine/estuarine biological tests, selected according to the Dredged Material Evaluation Framework (DMEF) (Corps et al. 1998) for the Lower Columbia River Management Area (LCRMA), was as follows:

- Acute 10-day *Eohaustorius estuarius* amphipod mortality test
- Chronic 20-day juvenile *Neanthes arenaceodentata* polychaete survival/growth test
- Acute 48-hour larval *Mytilus galloprovincialis* bivalve mortality/abnormality test.

### 4.1 Bioassay Reference Selection

Reference sediment samples were collected from two areas along the Lower Columbia River for use in the bioassay testing program. One reference sample was collected from inside the breakwater structure at the Port of Astoria's East Boat Basin (REF-EBB). The other reference sample was collected along the southwest shore of Youngs Bay, just south of the entrance to the Skipanon Waterway (REF-YB).

REF-EBB more closely matched the test sediments in terms of physical sediment characteristics, such as grain size. Based on physical and chemical analytical results, REF-EBB was selected as the reference sediment sample for use in bioassay testing. Selection of this reference sample was conducted in coordination with the PRP Group and based on our 2 June 2006 meeting with DEQ (Kennedy/Jenks Consultants 2006a).

### 4.2 Bioassay Results

The results of the three marine/estuarine bioassay tests are summarized on Tables 5 through 7 and discussed in the following sections. The complete laboratory bioassay reports are presented in Appendix D.

#### 4.2.1 Amphipod Mortality Test

The performance criterion for the selected reference sample REF-EBB was not met for mortality, according to the guidance in the LCRMA DMEF. Mean mortality in REF-EBB exceeded mean mortality in the negative control sample plus 20 percent (Corps et al. 1998). As discussed during our 2 June 2006 meeting with DEQ, the use of REF-EBB was agreed upon as an appropriate reference sediment for test comparison, based upon similar grain size characteristics and very low levels of non-target contamination.

The results of the acute 10-day amphipod mortality test are summarized on Table 5. Test samples SD-100, SD-101, and SD-102 resulted in 100 percent amphipod mortality, and test sample SD-103 yielded 61 percent mortality (Table 5). Of the three marine/estuarine tests run at

the Site, the greatest amphipod mortality occurred in sediment samples that contained the highest PAH concentrations. These were located in the southeast corner of Slip 2. Levels of PAHs decreased rapidly moving out beyond the containment boom, particularly at sample SD-103 and beyond to the northwest. The results of the other two tests are further discussed below.

Samples SD-100, SD-101, SD-102, and SD-103 resulted in “one-hit” failures compared to REF-EBB, based on the LCRMA DMEF (Corps et al. 1998). When any one biological test shows a marked test sediment response relative to the negative control and reference sediment which exceeds the bioassay-specific response guidelines, and which is “statistically different” from the reference, the dredged material management unit is judged to be unsuitable for aquatic disposal and is deemed a “one-hit” failure per the LCRMA DMEF (Corps et al. 1998). Sample SD-104 passed the amphipod mortality bioassay when compared to REF-EBB (Table 5).

The low interstitial salinity (i.e., 1 to 7 parts per thousand [ppt]) found in the sampled Site and reference sediments may have caused initial environmental stress to the marine test organisms unrelated to chemical toxicity, even though interstitial salinity by the end of the test was within the typical range (i.e., 25 to 29 ppt) (Table 5). This low interstitial salinity range in the bulk sediment may partially explain the poor performance criteria for organisms in the relatively clean reference sediment. In fact, neither reference sediment REF-EBB nor REF-YB met the performance criterion for the amphipod bioassay.

#### 4.2.2 Polychaete Survival/Growth Test

The results of the chronic 20-day polychaete survival and growth test are summarized on Table 6. None of the test samples showed significantly decreased individual survival or growth rate compared with reference sediment REF-EBB. Therefore, all test samples passed the “one-hit” criterion for mean survival and growth. The performance criterion was not met for survival/growth for the selected reference sample REF-EBB, i.e., the mean growth rate for REF-EBB was less than 80 percent of the negative control mean growth rate. However, DEQ agreed to use REF-EBB for statistical comparison purposes within the ERA during our 2 June 2006 meeting.

The results of the polychaete survival and growth test indicate the polychaete was not sensitive to the PAH constituents found in the test samples. Individual growth rates did not appear to be negatively impacted by the PAH concentrations whether the samples originated within the containment boom or were collected further out into Slip 2. Based on the relative insensitivity of the test, the results of the polychaete bioassay were not useful for the ERA but could be used to inform risk management decisions for the sediments found within Slip 2 during the FS phase of the project. The sublethal growth endpoint did not appear to be affected by the petroleum constituents found within the Slip 2 sediments.

#### 4.2.3 Larval Bivalve Mortality/Abnormality Test

The results of the acute 48-hour larval bivalve mortality and abnormality test are summarized on Table 7. The normalized combined mortality and abnormality (NCMA) for the five test samples ranged from 56.4 to 87.3 percent. Reference sample REF-EBB had a NCMA of 61.8 percent. All test samples passed under the “one-hit” criterion for NCMA. The performance criterion was not

met for NCMA for the selected reference sample REF-EBB, as the NCMA exceeded the seawater control plus 35 percent standard.

Results for the larval bivalve mortality and abnormality test were the most inconclusive of the three bioassays. Both reference samples performed poorly with little explanation for the source of larval abnormalities. Although initial interstitial salinity in the bulk test and reference sediments was low, this particular larval test mixes a small aliquot of sediment with typical salinity seawater and is thoroughly shaken (similar to an elutriate test for potential leaching of contaminants during dredging) prior to addition of the larvae. Therefore, low salinity cannot explain the poor NCMA performance of the reference sediments. Furthermore, test sediment SD-102, which contained the highest levels of PAH constituents of any sample, had the lowest percentage of NCMA (56.4 percent), i.e., the least amount of larval mortality/abnormality, and outperformed the “cleaner” reference sample REF-EBB (61.8 percent). Kennedy/Jenks has held discussions with the U.S. Army Corps of Engineers, DEQ, and NAS regarding performance issues with the juvenile polychaete and larval bivalve bioassay tests conducted in the Lower Columbia River estuary and Astoria region (Section 5.1).

## Section 5: Discussion

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This section provides a summary of uncertainty analysis and conclusion. A review of chemical data quality is provided in Appendix E.

### 5.1 Uncertainty Analysis

There are several sources of uncertainty associated with this ERA. The identification of the type and number of environmental samples, sampling procedures, and sample analysis each contain components that contribute to uncertainties in the ERA. For example, it is generally not practical to sample all locations and media at a site. Decisions are made to select a subset of potential sampling locations and media based upon the anticipated presence of the chemical(s), i.e., petroleum constituents. These decisions are made with the use of historical and background information on the site and potential contaminants' chemical and physical properties.

Additional uncertainties may arise out of the sampling process and analytical methodologies used in site characterization. For example, surface sediments were sampled and tested for chemical constituents as well as biological toxicity because they represent the current exposure pathway for ecological receptors in Slip 2. The underlying sediments were not tested because of the lack of an exposure pathway, but the conceptual site model could change with dredging to accommodate additional vessels or capping to address toxic surface sediments. Additional sampling and analytical testing may be required during the FS phase of the project, depending on the recommended remedial alternative.

Personal discussion with Mark Siipola of the Portland District U.S. Army Corps of Engineers indicated that other dredged material characterization projects recently conducted in the Lower Columbia River near Astoria also found similar low salinity and similar issues with the polychaete growth and acute larval bioassays (Kennedy/Jenks Consultants 2006b):

- East Astoria Boat Basin (Corps 1998) – the reference sediment for the juvenile polychaete bioassay did not meet performance criteria. All three test sediments for the larval NCMA bioassay failed the “one-hit” criteria, with only minor PAH exceedences of DMEF screening levels (SLs) for PAHs in one test sample. A previous exceedence of the SL for DDT prompted the bioassay testing; however, DDT was not detected at levels of concern in the bioassay test sediments.
- Skipanon Channel (Corps 2004) results – the reference sediment for the juvenile polychaete bioassay did not meet performance criteria, and test results were compared to the positive control. One test sediment for the larval NCMA bioassay failed the “one-hit” criteria, but no chemical concentrations exceeded their respective SLs in the test sediment. This test result, combined with the East Boat Basin result above, called the reliability of the larval test into question for the Astoria area.

A third bioassay site at Unocal Astoria (Environmental Cleanup Site Information [ECSI] File No. 1646) was referenced by DEQ for unexplained issues in the larval test, including poor NCMA correlation to the total PAH concentration gradient (DEQ 2006).

The marine/estuarine sediment bioassay protocols developed in Puget Sound may not perform as well in the Lower Columbia River estuary because of its unique hydrodynamics. The estuary experiences a large tidal range of up to 12 feet during maximum spring tides, as well as strong flood and ebb currents. Furthermore, low sediment interstitial salinities have been observed within the vicinity of the Site that pose unique bioassay testing challenges within the Lower Columbia River.

## 5.2 Conclusion

A Level III ERA was completed for the inwater portion of the Site, in particular the intertidal area in the southeast corner of Slip 2. The purpose of the ERA was to evaluate the potential for Site-related petroleum constituents to cause adverse toxicity to aquatic and benthic ecological receptors. The assessment endpoints to be protected at the Site included

- Protection of resident pelagic organisms (e.g., sculpin, stickleback, perch) from reproductive impairment caused by Site constituents
- Protection of the benthic invertebrate community from reproductive impairment caused by Site constituents.

The results of the ERA clearly indicate that petroleum constituents in the surface waters within Slip 2 are not causing adverse toxicity to pelagic aquatic ecological receptors, as all water column sample concentrations were below their respective FCVs or SLVs.

Petroleum constituents within a small area of sediment in the southeast corner of Slip 2, encompassing the area just outside the containment boom and the shoreline, appears to be causing mortality and adverse toxicity to benthic organisms. The “one-hit” failures in the amphipod mortality bioassay indicated unacceptable toxicity in samples SD-100, SD-101, SD-102, and SD-103. Results of the juvenile polychaete bioassay indicate the concentrations of petroleum constituents found in Slip 2 sediments are not at sufficient levels to affect the sublethal or chronic growth endpoint. None of the test organisms failed the juvenile polychaete survival/growth bioassay test.

The larval bivalve mortality/abnormality bioassay results were the most inconclusive of the three tests. None of the test organisms failed the bioassay, but the NCMA results did not trend with the PAH concentrations in sediment. Both the juvenile polychaete and larval bivalve tests had poor performance issues with the reference sediments. These issues were similarly encountered at other bioassay testing sites around the Lower Columbia River estuary.

Based on the results of the ERA, the recommendation is to address the inwater sediments just outside the containment boom to the shoreline during the FS phase of the project. A remedial alternative that eliminates the source of the petroleum constituents and addresses the benthic toxicity of the surface sediments is the most desirable. Any additional sediment sampling to inform remedial decision-making will be conducted during the FS phase.



## Section 6: References

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## Tables

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Table 1: Sampling Station Coordinates

Station ID	Latitude	Longitude	Approximate Depth to Mudline (ft)	Approximate Tidal Height (ft)	Approximate Depth to Mudline (ft) (ft) <sup>(a)</sup>
SD-100/SW-100	46° 11' 13.9" N	123° 51' 35.9" W	5	7.8	-2.8
SD-101/SW-101	46° 11' 14.1" N	123° 51' 35.9" W	2.5	6.8	-4.3
SD-102/SW-102	46° 11' 14.4" N	123° 51' 35.3" W	1.5	5.6	-4.1
SD-103	46° 11' 14.1" N	123° 51' 36.6" W	6	4.6	1.4
SD-104/SW-104	46° 11' 13.6" N	123° 51' 38.8" W	10	3.7	6.3
SW-105	46° 11' 16.1" N	123° 51' 41.7" W	22	2.7	19.3
REF-EBB	46° 11' 51.5" N	123° 48' 00.0" W	16	0.2	15.8
REF-YB	46° 10' 43.6" N	123° 54' 03.0" W	2.5	1.8	0.7

**Notes:**

(a) Depth to mudline has been tide corrected to Columbia River Datum (CRD).

EBB = East Boat Basin

REF = Reference Sample

SD = Sediment Sample

SW = Surface Water Sample

YB = Youngs Bay

Table 2: Surface Water Chemical Analytical Results

Sample ID	Sample Date	Approximate Water Depth (ft) <sup>(a)</sup>	LPAH Compounds (µg/L)						
			Naphthalene	2-Methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
SW-100	1/26/2006	-2.8	0.0082 J	0.0039 J	0.0018 U	0.004 J	0.0034 J	0.0092 J	0.0030 J
SW-101	1/26/2006	-4.3	0.14	0.082	0.0058 J	0.0097 J	0.0076 J	0.012 J	0.0033 J
SW-102	1/26/2006	-4.1	0.21	0.14	0.0077 J	0.015 J	0.011 J	0.015 J	0.0050 J
SW-104	1/26/2006	1.4	0.017 J	0.0095 J	0.0018 U	0.0023 J	0.0026 U	0.0048 J	0.0011 U
SW-105	1/26/2006	6.3	0.0080 J	0.0027 J	0.0018 U	0.0027 J	0.0026 U	0.0051 J	0.0013 J
EPA FCV or DEQ SLV <sup>(b)</sup>			193.5	72.16	306.9	55.85	39.3	19.13	20.73

Table 2: Surface Water Chemical Analytical Results

Sample ID	Sample Date	Approximate Water Depth (ft) <sup>(a)</sup>	HPAH Compounds (µg/L)							
			Fluoranthene	Pyrene	Benz(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-c,d)-pyrene
SW-100	1/26/2006	-2.8	0.012 J	0.013 J	0.0021 U	0.0048 J	0.0032 J	0.0020 J	0.0016 U	0.0021 U
SW-101	1/26/2006	-4.3	0.016 J	0.020 J	0.0021 U	0.0035 J	0.0029 J	0.0019 J	0.0017 J	0.0030 J
SW-102	1/26/2006	-4.1	0.022	0.025	0.0021 U	0.0051 J	0.0020 J	0.0014 J	0.0016 U	0.0021 U
SW-104	1/26/2006	1.4	0.0038 J	0.0030 J	0.0021 U	0.0013 U	0.0020 U	0.0014 U	0.0016 U	0.0021 U
SW-105	1/26/2006	6.3	0.0049 J	0.0041 J	0.0021 U	0.0016 J	0.0020 U	0.0014 U	0.0016 U	0.0021 U
EPA FCV or DEQ SLV <sup>(b)</sup>			7.109	10.11	2.227	2.042	0.6774	0.6415	0.9573	0.275



Table 2: Surface Water Chemical Analytical Results

Sample ID	Sample Date	Approximate Water Depth (ft) <sup>(a)</sup>	HPAH Compounds (µg/L)		Volatile Organic Compounds (µg/L)			
			Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene	Benzene	Toluene	Ethylbenzene	Xylene
SW-100	1/26/2006	-2.8	0.0017 U	0.0037 U	0.14 U	0.12 J	0.13 U	0.22 U
SW-101	1/26/2006	-4.3	0.0022 J	0.0037 U	0.61	2.7	0.47 J	2.64
SW-102	1/26/2006	-4.1	0.0017 U	0.0037 U	0.89	3.9	0.68	3.7
SW-104	1/26/2006	1.4	0.0017 U	0.0037 U	0.14 U	0.12 J	0.13 U	0.22 U
SW-105	1/26/2006	6.3	0.0017 U	0.0037 U	0.14 U	0.11 U	0.13 U	0.22 U
EPA FCV or DEQ SLV <sup>(b)</sup>			0.2825	0.4391	130	9.8	7.3	13

**Notes:**

(a) Depth to mudline has been tide corrected to Columbia River Datum (CRD).

(b) EPA FCV for chronic toxicity of individual PAHs in water exposures, or DEQ SLV for BTEX for aquatic organisms in surface water.

BTEX = Benzene, toluene, ethylbenzene, and xylene.

DEQ = Oregon Department of Environmental Quality.

EPA = Environmental Protection Agency.

FCV = Final Chronic Value.

HPAH = Heavy polynuclear aromatic hydrocarbon.

J = Detected concentration was below the laboratory method reporting limit and above the method detection limit.

LPAH = Light polynuclear aromatic hydrocarbon.

SLV = Screening Level Value.

SW = Surface water sample.

U = Concentration was below the laboratory method detection limit.

Table 3: Sediment Physical Characteristics

Sample ID	Sample Date	Approximate	Conventional Sediment Parameters						Grain Size	
		Water Depth (ft) <sup>(a)</sup>	Sample Depth (cm)	Ammonia (mg/kg)	Total Solids (%)	Total Volatile Solids (%)	Total Organic Carbon (TOC)(%)	Total Sulfide (mg/kg)	Percent Sand/Gravel	Percent Silt/Clay
SD-100	1/26/2006	-2.8	0-10	21.4	46.5	6.48	2.60	1,030	29.1	73.5
SD-101	1/26/2006	-4.3	0-10	69.0	40.9	10.3	4.45	1,540	18.8	82.8
SD-102	1/26/2006	-4.1	0-10	16.6	27.1	29.2	15.6	699	54.8	50.5
SD-103	1/26/2006	1.4	0-10	66.8	43.7	6.77	2.39	2,340	9.9	87.0
SD-104	1/26/2006	6.3	0-10	47.9	45.1	6.42	2.04	1,620	8.2	94.4
REF-EBB	1/26/2006	15.8	0-10	43.3	49.0	5.46	1.72	1,320	13.7	87.3
REF-YB	1/26/2006	0.7	0-10	40.5	56.5	4.91	1.36	447	35.0	68.2

**Note:**

(a) Depth to mudline has been tide corrected to Columbia River Datum (CRD).

Table 4: Sediment Chemistry and Grain Size Results

Sample ID	Sample Date	Approximate Water Depth (feet) <sup>(a)</sup>	Sample Depth (cm)	Grain Size		Metals (mg/kg)							
				Percent Sand Gravel	Percent Silt/Clay	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Silver	Zinc
SD-100	1/26/2006	-2.8	0-10	29.1	73.5	3.34	0.42	13.2	21	14.4	0.073	0.117	72.2
SD-101	1/26/2006	-4.3	0-10	18.8	82.8	6.97	0.498	15	33.6	17.8	0.1	0.122	144
SD-102	1/26/2006	-4.1	0-10	54.8	50.5	8.24	0.472	17.6	55	25.4	0.079	0.098	218
SD-103	1/26/2006	1.4	0-10	9.9	87.0	4.41	0.578	15	31	15	0.095	0.133	81.2
SD-104	1/26/2006	6.3	0-10	8.2	94.4	4.45	0.593	14.9	27.7	13.7	0.12	0.142	78.9
REF-EBB	1/26/2006	15.8	0-10	13.7	87.3	3.22	0.407	11.7	20.9	10.8	0.194	0.121	62.5
REF-YB	1/26/2006	0.7	0-10	35.0	68.2	4.8	0.759	15.7	20.3	19.4	0.178	0.155	85.8
DEQ SLV <sup>(b)</sup>						7	0.7	52	19	30	0.1	0.7	124

Table 4: Sediment Chemistry and Grain Size Results

Sample ID	Sample Date	Approximate Water Depth (feet) <sup>(a)</sup>	Sample Depth (cm)	LPAH Compounds (µg/kg)							Total LPAH
				Naphthalene	2-Methyl-naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	
SD-100	1/26/2006	-2.8	0-10	7.1 J	2.6 U	3.1 U	2.2 U	3.7 U	280 U	310 U	310 U
SD-101	1/26/2006	-4.3	0-10	<b>40</b>	20	350 U	250 U	420 U	<b>540</b> JD	350 U	<b>600</b> JD
SD-102	1/26/2006	-4.1	0-10	<b>160</b>	<b>60</b>	520 U	370 U	630 U	<b>620</b> JD	<b>700</b> JD	<b>1,540</b> JD
SD-103	1/26/2006	1.4	0-10	7.0 J	8.3 J	<b>15</b>	<b>10</b> J	<b>45</b>	<b>110</b>	<b>480</b>	<b>675</b> J
SD-104	1/26/2006	6.3	0-10	2.9 U	2.7 U	3.2 U	2.3 U	3.8 U	8.6 J	3.2 U	8.6 J
REF-EBB	1/26/2006	15.8	0-10	2.7 U	2.5 U	2.9 U	2.1 U	3.5 U	4.1 J	2.9 U	4.1 J
REF-YB	1/26/2006	0.7	0-10	2.4 U	2.2 U	2.5 U	1.8 U	3.1 U	3.7 J	2.5 U	3.7 J
DEQ SLV <sup>(b)</sup>				35	20	6	7	21	86	47	312

Table 4: Sediment Chemistry and Grain Size Results

Sample ID	Sample Date	Approximate Water Depth (feet) <sup>(a)</sup>	Sample Depth (cm)	HPAH Compounds (µg/kg)							
				Fluoranthene	Pyrene	Benz(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-c,d)-pyrene
SD-100	1/26/2006	-2.8	0-10	650 JD	290	120	210	160	54	76	48
SD-101	1/26/2006	-4.3	0-10	2,000 D	570	240	710	380	120	160	96
SD-102	1/26/2006	-4.1	0-10	4,100 D	1,100	920	2,500 D	1,400 JD	300	450	280
SD-103	1/26/2006	1.4	0-10	250	280	170	320	170	58	58	39
SD-104	1/26/2006	6.3	0-10	20	22	10 J	18	15	5.8 J	11 J	8.8 J
REF-EBB	1/26/2006	15.8	0-10	12	15	6.6 J	9.3 J	11 J	5.2 U	9.3 J	7.3 J
REF-YB	1/26/2006	0.7	0-10	11	13	5.8 J	8.6 J	10	4.5 U	9.3 J	7.7 J
DEQ SLV <sup>(b)</sup>				113	152	75	107	1,800	1,800	89	600

Table 4: Sediment Chemistry and Grain Size Results

Sample ID	Sample Date	Approximate Water Depth (feet) <sup>(a)</sup>	Sample Depth (cm)	HPAH Compounds (µg/kg)				Chlorinated Benzenes (µg/kg)			
				Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene	Total HPAH	Total PAH	1,2-Dichloro-benzene	1,4-Dichloro-benzene	1,2,4-Trichloro-benzene	Hexachloro-benzene
SD-100	1/26/2006	-2.8	0-10	11	44	1,663 JD	1,663 JD	2.8 U	4.1 U	3.3 U	460 U
SD-101	1/26/2006	-4.3	0-10	19	74	4,369 D	4,969 JD	3.2 U	4.7 U	3.7 U	520 U
SD-102	1/26/2006	-4.1	0-10	56	210	11,316 JD	12,856 JD	4.8 U	7.1 U	5.6 U	780 U
SD-103	1/26/2006	1.4	0-10	8.4 J	32	1,385 J	2,060 J	3.0 U	4.4 U	3.5 U	4.9 U
SD-104	1/26/2006	6.3	0-10	4.9 U	9.3 J	120 J	128.6 J	2.9 U	4.3 U	3.4 U	4.7 U
REF-EBB	1/26/2006	15.8	0-10	4.5 U	7.8 J	78.3 J	82.4 J	2.7 U	3.9 U	3.1 U	4.3 U
REF-YB	1/26/2006	0.7	0-10	3.9 U	9.3 J	74.7 J	78.4 J	2.4 U	3.4 U	2.7 U	3.8 U
DEQ SLV <sup>(b)</sup>				6	670	665	1,684	13	110	5	6



Table 4: Sediment Chemistry and Grain Size Results

Sample ID	Sample Date	Approximate Water Depth (feet) <sup>(a)</sup>	Sample Depth (cm)	Phthalate Esters (µg/kg organic carbon)					
				Dimethyl phthalate	Diethyl phthalate	Di-n-butyl phthalate	Butyl benzyl phthalate	Bis(2-ethylhexyl)-phthalate	Di-n-octyl phthalate
SD-100	1/26/2006	-2.8	0-10	3.9 U	7.6 U	560 U	3.3 U	140 J	28
SD-101	1/26/2006	-4.3	0-10	450 U	860 U	640 U	5.0 U	120 J	<b>100</b>
SD-102	1/26/2006	-4.1	0-10	670 U	1,300 U	960 U	5.6 U	160 J	4.5 U
SD-103	1/26/2006	1.4	0-10	4.2 U	8.1 U	6.0 U	3.5 U	18 J	2.8 U
SD-104	1/26/2006	6.3	0-10	4.0 U	7.8 U	5.8 U	3.4 U	7.6 J	2.7 U
REF-EBB	1/26/2006	15.8	0-10	3.7 U	7.2 U	5.4 U	3.1 U	6.1 J	2.5 U
REF-YB	1/26/2006	0.7	0-10	3.2 U	6.2 U	4.7 U	2.7 U	3.7 J	2.2 U
DEQ SLV <sup>(b)</sup>				6	6	58	63	1,300	61

Table 4: Sediment Chemistry and Grain Size Results

Sample ID	Sample Date	Approximate Water Depth (feet) <sup>(a)</sup>	Sample Depth (cm)	Misc. Extractable Compounds (µg/kg)				Ionizable Organic Compounds (µg/kg)							
				Dibenzo-furan	Hexachloro-butadiene	N-nitroso-diphenylamine	Total PCBs <sup>(d)</sup>	Porewater Tri-n-butyltin	Phenol	2-Methyl-phenol	4-Methyl-phenol	2,4-Dimethyl-phenol	Pentachloro-phenol	Benzyl Alcohol	Benzoic Acid
SD-100	1/26/2006	-2.8	0-10	2.8 U	3.1 U	4.8 U	<b>46</b>	0.065 JD	15 J	7.4 U	6.3 U	12 U	1,900 U	8.0 U	210 U
SD-101	1/26/2006	-4.3	0-10	320 U	3.5 U	540 U	<b>58</b>	0.081 JD	11 J	8.4 U	22	14 U	2,100 U	9.1 U	240 U
SD-102	1/26/2006	-4.1	0-10	480 U	5.2 U	820 U	<b>135</b>	0.058 JD	19 J	13 U	25	21 U	3,200 U	14 U	360 U
SD-103	1/26/2006	1.4	0-10	16	3.3 U	5.1 U	17.5 J	0.028 JD	7.0 J	7.8 U	8.7 J	13 U	20 U	8.5 U	220 U
SD-104	1/26/2006	6.3	0-10	2.9 U	3.2 U	4.9 U	6.1 J	0.013 J	8.6 J	7.6 U	6.5 U	13 U	19 U	8.3 U	220 U
REF-EBB	1/26/2006	15.8	0-10	2.7 U	2.9 U	4.5 U	3.3 U	0.013 J	8.0 J	7.0 U	6.0 U	12 U	18 U	7.6 U	200 U
REF-YB	1/26/2006	0.7	0-10	2.4 U	2.5 U	3.9 U	<b>23</b> J	0.010 J	5.5 J	6.1 U	5.2 U	9.8 U	16 U	6.6 U	170 U
DEQ SLV <sup>(b)</sup>				110	1	28	22	0.15 <sup>(c)</sup>	130	8	100	18	17	52-57	65

**Notes:**

Chemical results exceeding sediment benchmarks are shown in **bold**.

(a) - Depth to mudline has been tide corrected to Columbia River Datum (CRD).

(b) - DEQ SLV for marine/estuarine sediment.

(c) - PSDDA screening level for tri-n-butyltin in sediment.

(d) - Total PCBs are the sum of the detected Aroclor PCBs 1248, 1254, and 1260.

D = PAHs were diluted by a factor of 100, and tri-n-butyltin was diluted by a factor of 4 to obtain concentration.

J = Estimated concentration was less than the method reporting limit (MRL) and greater than or equal to the method detection limit (MDL).

U = Analyte concentration was not detected at or above the MRL/MDL.

µg/kg = micrograms per kilogram.

cm = centimeter.

DEQ = Oregon Department of Environmental Quality.

EBB = East Boat Basin.

ft = feet.

HPAH = heavy polycyclic aromatic hydrocarbon.

LPAH = light polycyclic aromatic hydrocarbon.

mg/kg = milligrams per kilogram.

PAH = polycyclic aromatic hydrocarbon.

PCB = polychlorinated biphenyl.

PSDDA = Puget Sound Dredge Disposal Analysis.

REF = Reference Sample.

SD = Sediment Sample.

SLV = Screening Level Value.

YB = Youngs Bay.

Table 5: Summary of Acute 10-Day Amphipod Mortality Bioassay Results

Sample	Test Mean Mortality ( $M_T$ ) (%)	Significantly Different from REF-EBB at $\alpha = 0.05$ ?	REF-EBB Reference Mean Mortality ( $M_R$ ) (%)	$M_T - M_R$	One-Hit Criteria <sup>(a)</sup> ( $M_T - M_R > 30\%$ ) (Pass/Fail)	Two-Hit Criteria <sup>(b)</sup> (significant difference from reference in any two tests)	Bulk Interstitial Salinity (ppt)
						(Yes/No)	
SD-100	100	Yes	23.0	77.0	Fail	Yes	1.5
SD-101	100	Yes	23.0	77.0	Fail	Yes	3.0
SD-102	100	Yes	23.0	77.0	Fail	No	1.0
SD-103	61.0	Yes	23.0	38.0	Fail	Yes	4.5
SD-104	24.0	No	23.0	1.0	Pass	No	5.0
REF-EBB	23.0	--	--	--	--	--	5.0
REF-YB	61.0	--	--	--	--	--	7.0
Neg. Control	1.0	--	--	--	--	--	--

**Notes:**

(a) One hit required to fail bioassay.

(b) Two hits required to fail bioassay.

ppt - parts per thousand.

Table 6: Summary of Chronic 20-Day Juvenile Polychaete Survival and Growth Bioassay Results

Sample	Test Mean Growth Rate ( $G_T$ )	Significantly Different from REF-EBB at $\alpha = 0.05$ ?	REF-EBB Reference Mean Growth Rate ( $G_R$ )	$G_R \times 50\%$	One-Hit Criteria <sup>(a)</sup> ( $G_T < G_R \times 50\%$ ) (Pass/Fail)	Two-Hit Criteria <sup>(b)</sup> (significant difference from reference in any two tests) (Yes/No)	Bulk Interstitial Salinity (ppt)
SD-100	0.74	No	0.79	0.395	Pass	Yes	1.5
SD-101	0.79	No	0.79	0.395	Pass	Yes	3.0
SD-102	0.83	No	0.79	0.395	Pass	No	1.0
SD-103	0.73	No	0.79	0.395	Pass	Yes	4.5
SD-104	0.80	No	0.79	0.395	Pass	No	5.0
REF-EBB	0.79	--	--	--	--	--	5.0
REF-YB	1.09	--	--	--	--	--	7.0
Neg. Control	1.03	--	--	--	--	--	--

**Notes:**

(a) One hit required to fail bioassay.

(b) Two hits required to fail bioassay.

Table 7: Summary of Acute 48-Hour Larval Combined Mortality and Abnormality Bioassay Results

Sample	Test Mean NCMA (N <sub>T</sub> ) (%)	Significantly Different from REF-EBB at $\alpha = 0.10$ ?	REF-EBB Reference Mean NCMA (N <sub>R</sub> ) (%)	N <sub>R</sub> + 30%	One-Hit Criteria <sup>(a)</sup>	Two-Hit Criteria <sup>(b)</sup>
					(N <sub>T</sub> > N <sub>R</sub> + 30%) (Pass/Fail)	(significant difference from reference in any two tests) (Yes/No)
SD-100	80.2	Yes	61.8	91.8	Pass	Yes
SD-101	87.3	Yes	61.8	91.8	Pass	Yes
SD-102	56.4	No	61.8	91.8	Pass	No
SD-103	79.1	Yes	61.8	91.8	Pass	Yes
SD-104	77.1	Yes	61.8	91.8	Pass	No
REF-EBB	61.8	--	--	--	--	--
REF-YB	52.0	--	--	--	--	--
SW Control	0.0	--	--	--	--	--

**Notes:**

(a) One hit required to fail bioassay.

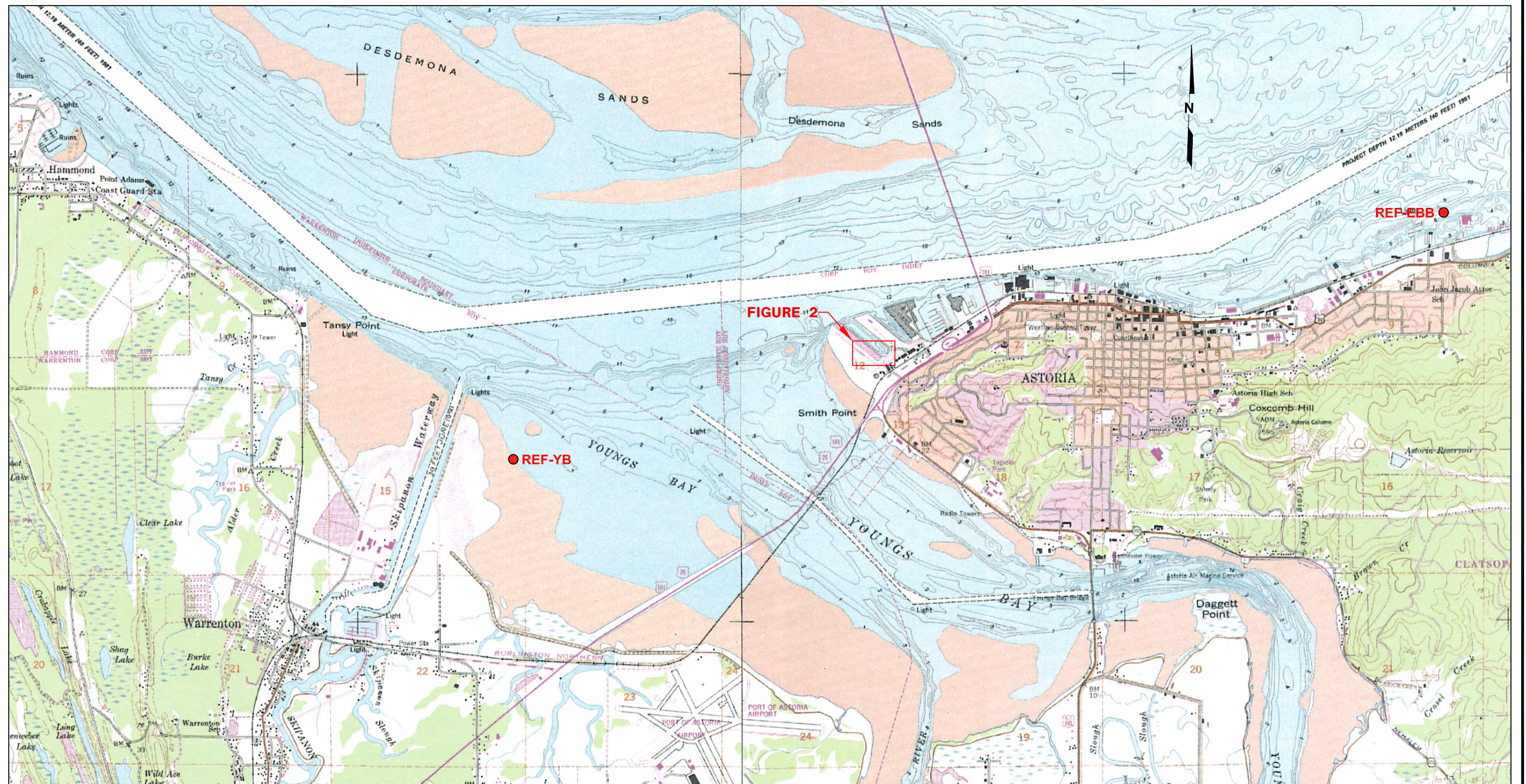
(b) Two hits required to fail bioassay.

SW - seawater.

## Figures

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LEGEND :

REF-EBB ● REFERENCE SEDIMENT SAMPLE

1,500 0 3,000  
Approximate Scale in Feet

**Kennedy/Jenks Consultants**

ECOLOGICAL RISK ASSESSMENT  
ASTORIA, OREGON

REFERENCE SEDIMENT STATIONS

Figure 1  
K/J 0592004.00



Q:\Projects\0592004.00\_Astoria Area-Wide PPP Group\09 - ERA Report\Figures\0592004\_00 - FIGURE 2.dwg Sep 20, 2006 - 9:32am

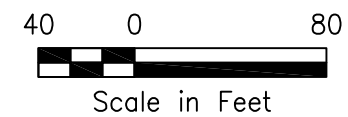


## LEGEND :

- SD-101 ● SURFACE SEDIMENT SAMPLE  
SW-101 ● WATER COLUMN SAMPLE

### Notes:

1. Base map prepared from AutoCAD file provided by EnviroLogic Resources, Inc., dated 5/02.



## Kennedy/Jenks Consultants

ECOLOGICAL RISK ASSESSMENT  
ASTORIA, OREGON

SLIP 2 SAMPLING STATIONS

Figure 2  
K/J 0592004.00



## Appendix A

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### Photographs



**Photo #1:** Looking at the Van Dorn sampler post-deployment with water column sample inside.



**Photo #2:** Looking at the northwestern outer edge of the containment boom in Slip 2.



**Photo #3:** Looking toward the eastern corner of Slip 2.



**Photo #4:** Looking south at the containment boom in Slip 2 toward the Port offices.

## Appendix B

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### Sediment Sampling Data Sheets

**SEDIMENT SAMPLING DATA SHEET**

PROJECT NAME: Astoria Area - Wide		K/IJ #: 0592004.00
K/IJ PERSONNEL: TP + CR		DATE: 1/26/06
SUBCONTRACTOR: NWBC		WEATHER: cold, rainy, windy
SAMPLING METHOD: Diver Core		
SAMPLE ID: SD-100	LATITUDE:	
WATER DEPTH: 5'	LONGITUDE:	
TIDAL HEIGHT: ~ 7.8'		
CORRECTED DEPTH: ~ -2.8'		

[illegible]

**NOTES AND ANALYSES:**

## SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: Astoria Area - Wide	K/J #: 0592004.00
K/J PERSONNEL: TP + CR	DATE: 1/26/06
SUBCONTRACTOR: NWUC	WEATHER:
SAMPLING METHOD: Diver Core	
SAMPLE ID: SD-101	LATITUDE:
WATER DEPTH: 2.5'	LONGITUDE:
TIDAL HEIGHT: ~ 6.8'	
CORRECTED DEPTH: - 4.3'	

RUN #	TIME	SAMPLE DEPTH	OBSERVATIONS	ACCEPT?
			(grain size, color, odor, sheen, organisms, shells, debris)	
1	1220	10	greyish black silt, petroleum odor, sheen, woody debris	Y

NOTES AND ANALYSES:

## SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: Astoria Area-Wide	K/J #: 0592004.00
K/J PERSONNEL: TP + CR	DATE:
SUBCONTRACTOR: NWUL	WEATHER:
SAMPLING METHOD: Diver Core	
SAMPLE ID: SD-102	LATITUDE:
WATER DEPTH: 1.5'	LONGITUDE:
TIDAL HEIGHT: ~ 5.6'	
CORRECTED DEPTH: ~ - 4.1'	

RUN #	TIME	SAMPLE DEPTH	OBSERVATIONS	ACCEPT?
			(grain size, color, odor, sheen, organisms, shells, debris)	
1	1300	10	greyish sandy silt, petroleum odor, slight sheen, lots of woody debris	Y

NOTES AND ANALYSES:

## SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: <i>Astoria Area - Wide</i>	K/J #: <i>05 92004.00</i>
K/J PERSONNEL: <i>TP + CR</i>	DATE: <i>11-26-06</i>
SUBCONTRACTOR: <i>NWUC</i>	WEATHER:
SAMPLING METHOD: <i>Diver Core</i>	
SAMPLE ID: <i>SD-103</i>	LATITUDE:
WATER DEPTH: <i>6'</i>	LONGITUDE:
TIDAL HEIGHT: <i>~ 4.6'</i>	
CORRECTED DEPTH: <i>~ 11.4'</i>	

RUN #	TIME	SAMPLE DEPTH	OBSERVATIONS	ACCEPT?
			(grain size, color, odor, sheen, organisms, shells, debris)	
<i>1</i>	<i>1330</i>	<i>10</i>	<i>brownish grey silt, petroleum odor, slight sheen, no debris</i>	<i>y</i>

NOTES AND ANALYSES:



**SEDIMENT SAMPLING DATA SHEET**[illegible]

## SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: <i>Astoria Area-Wide</i>	K/J #: <i>0592004, 00</i>
K/J PERSONNEL: <i>TP + CR</i>	DATE: <i>1/26/06</i>
SUBCONTRACTOR: <i>NWUC</i>	WEATHER:
SAMPLING METHOD: <i>Diver Core</i>	
SAMPLE ID: <i>REF-ERB</i>	LATITUDE:
WATER DEPTH: <i>16'</i>	LONGITUDE:
TIDAL HEIGHT: <i>~0.2'</i>	
CORRECTED DEPTH: <i>~15.8'</i>	

RUN #	TIME	SAMPLE DEPTH	OBSERVATIONS	ACCEPT?
			(grain size, color, odor, sheen, organisms, shells, debris)	
<i>1</i>	<i>1630</i>	<i>10</i>	<i>Brownish black silt, no odor, no sheen, no debris</i>	<i>y</i>

## NOTES AND ANALYSES:

*70% fines by wet sieve*

## SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: Astoria Area - wide		K/J #: 0592004.00
K/J PERSONNEL: TP + CR		DATE: 1/26/06
SUBCONTRACTOR: NWVC		WEATHER:
SAMPLING METHOD: Diver Core		
SAMPLE ID: REF-4B	LATITUDE:	
WATER DEPTH: 2.5'	LONGITUDE:	
TIDAL HEIGHT: ~1.8'		
CORRECTED DEPTH: ~0.7'		

[illegible]

**NOTES AND ANALYSES:**

68% fines by wet sieve

## Appendix C

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Laboratory Chemical Analytical Reports

February 21, 2006

Service Request No: K0600765

Taku Fuji  
Kennedy/Jenks Consultants, Incorporated  
200 SW Market St., Suite 500  
Portland, OR 97201-5715

**RE: Astoria Area-Wide/0592004.00**

Dear Taku:

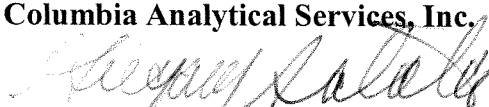
Enclosed are the results of the sample(s) submitted to our laboratory on January 28, 2006. For your reference, these analyses have been assigned our service request number K0600765.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAC standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3376.

Respectfully submitted,

**Columbia Analytical Services, Inc.**



Gregory Salata, Ph.D.  
Project Chemist

GS/jeb

Page 1 of 131

## Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

### **Inorganic Data Qualifiers**

- \* The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
- U The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
- i The MRL/MDL has been elevated due to a matrix interference.
- X See case narrative.

### **Metals Data Qualifiers**

- # The control limit criteria is not applicable. See case narrative.
- B The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL has been elevated due to a matrix interference.
- X See case narrative.
- \* The duplicate analysis not within control limits. See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.

### **Organic Data Qualifiers**

- \* The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results (25% for CLP Pesticides).
- U The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
- i The MRL/MDL has been elevated due to a chromatographic interference.
- X See case narrative.

### **Additional Petroleum Hydrocarbon Specific Qualifiers**

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

## **Case Narrative**



## COLUMBIA ANALYTICAL SERVICES, INC.

**Client:** Kennedy/Jenks Consultants, Inc.  
**Project:** Astoria Area-Wide/592004.00  
**Sample Matrix:** Water and Soil

**Service Request No.:** K0600765  
**Date Received:** 01/28/06

### CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix/Duplicate Matrix Spike (MS/DMS), and Laboratory/Duplicate Laboratory Control Sample (LCS/DLCS).

#### Sample Receipt

Seven soil and six water samples were received for analysis at Columbia Analytical Services on 01/28/06. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

#### General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

#### Total Metals

No anomalies associated with the analysis of these samples were observed.

#### PCB Aroclors by EPA Method 8082

##### **Sample Confirmation Notes:**

JP-The confirmation comparison criteria are not applicable because at least one of the values is below the Method Reporting Limit (MRL).

The confirmation comparison criteria of 40% difference for Aroclor 1254 was exceeded in a few samples. The lower of the two values was reported because of an apparent interference on the alternate column that produced the higher value.

##### **Elevated Method Reporting Limits:**

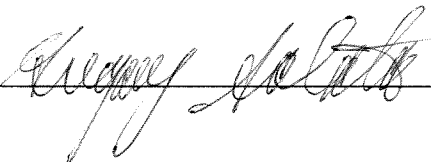
The reporting limit is elevated for several analytes in samples SD-100, SD-101, and SD-102. The chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compounds at the reporting limit. The results are flagged to indicate the matrix interference.

No other anomalies associated with the analysis of these samples were observed.

#### Organotin Compounds

No anomalies associated with the analysis of these samples were observed.

Approved by



Date

2/2/06

## **Volatile Organic Compounds by EPA Method 8260B**

### **Lab Control Sample Exceptions:**

The advisory criterion was exceeded for the following analyte in Laboratory Control Sample (LCS) KWG0602222-3: Ethylbenzene. As per the CAS/Kelso Standard Operating Procedure (SOP) for this method, these compounds are not included in the subset of analyte used to control the analysis. The recovery information reported for these analyte is for advisory purposes only (i.e. to provide additional detail related to the performance of each individual compound). No further corrective action was required.

No other anomalies associated with the analysis of these samples were observed.

## **Semivolatile Organic Compounds by EPA Method 8270C**

### **Initial Calibration (ICAL) Exceptions:**

The primary evaluation criterion was exceeded for Benzoic Acid, 2-Nitroaniline, 2,6-Dinitrotoluene, 3-Nitroaniline, 4-Nitrophenol, 2,3,4,6-Tetrachlorophenol, 4-Nitroaniline, and 2,4,6-Tribromophenol in ICAL ID CAL5128. In accordance with CAS standard operating procedures, the alternative evaluation specified in the EPA method was performed using the mean Relative Standard Deviation (RSD) of all analytes in the calibration. The result of the mean RSD calculation was 8.7%. The calibration meets the alternative evaluation criteria. Note that CAS/Kelso policy does not allow the use of averaging if any analyte in the ICAL exceeds 30% RSD.

### **Surrogate Exceptions:**

The control criteria for the 2,4,6-Tribromophenol surrogate in sample SD-100 are not applicable. The control criteria for the 2-Fluorobiphenyl, and 2,4,6-Tribromophenol surrogates in samples SD-101 and SD-102 are not applicable. The analysis of the sample required a dilution, which resulted in a surrogate concentration below the Method Reporting Limit (MRL). No further corrective action was appropriate.

### **Lab Control Sample Exceptions:**

The advisory criterion was exceeded for Benzoic Acid and Chrysene in Laboratory Control Sample (LCS) KWG0601824-3. As per the CAS/Kelso Standard Operating Procedure (SOP) for this method, these compounds are not included in the subset of analytes used to control the analysis. The recovery information reported for these analytes is for advisory purposes only (i.e. to provide additional detail related to the performance of each individual compound). No further corrective action was required.

### **Relative Percent Difference Exceptions:**

The Relative Percent Difference (RPD) for Benzoic Acid in the replicate Laboratory Control Sample (LCS) analyses (KWG0601824-3 and KWG0601824-4) was outside control criteria. The analyte in question was not detected in the associated field samples. The data quality is not significantly affected. No further corrective action was appropriate.

### **Elevated Method Reporting Limits:**

Samples SD-100, SD-101, and SD-102 required dilutions due to the presence of elevated levels of target analyte. The reporting limits are adjusted to reflect the dilution.

No other anomalies associated with the analysis of these samples were observed.

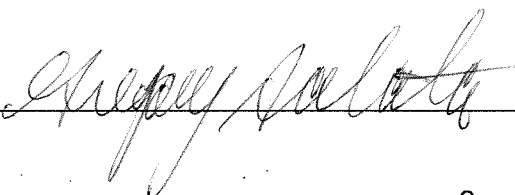
## **Polynuclear Aromatic Hydrocarbons by EPA Method 8270C**

### **Sample Notes and Discussion**

Insufficient sample volume was received to perform a Matrix Spike/Matrix Spike Duplicate (MS/MSD). A Laboratory Control Sample/Duplicate Laboratory Control Sample (LCS/DLCS) was analyzed and reported in lieu of the MS/MSD for these samples.

No other anomalies associated with the analysis of these samples were observed.

Approved by



Date

2/21/06

## **Chain of Custody Documentation**

# CHAIN OF CUSTODY

<b>PROJECT NAME</b> Astoria Area - wide <b>PROJECT NUMBER</b> 0592004.00 <b>PROJECT MANAGER</b> Taku Fuji <b>COMPANY ADDRESS</b> Kennedy Jinks Consultants 200 SW Market St., Suite 500 Portland, OR 97201 <b>E-MAIL ADDRESS</b> TakuFuji@kennedyjinks.com <b>PHONE #</b> 503-245-4911 FAX 503-245-4901 <b>SAMPLER'S SIGNATURE</b> <i>[Signature]</i>						
<b>SAMPLE I.D.</b> SD-100 SD-101 SD-102 SD-103 SD-104 REF-EBB REF-YRB	<b>DATE</b> 11/24/01       	<b>TIME</b> 1145 1220 1300 1330 1400 1630 1510	<b>LAB I.D.</b> S 2 3 4 4 4 7	<b>MATRIX</b> 4 4 4 4 4 4 4	<b>NUMBER OF CONTAINERS</b> Semivolatile Organics by GC/MS 625 <input type="checkbox"/> 8270 <input type="checkbox"/> 8270LL <input checked="" type="checkbox"/> Volatile Organics 624 <input type="checkbox"/> 8260 <input type="checkbox"/> 8021 <input type="checkbox"/> BTEX <input type="checkbox"/> Hydrocarbons (*see below) Gas <input type="checkbox"/> Diesel <input type="checkbox"/> Oil <input type="checkbox"/> <input type="checkbox"/> Fuel Fingerprint (FIQ) <input type="checkbox"/> NW-HCID Screen Oil & Grease/TRPH 1664 HEM <input type="checkbox"/> 1664 SGT <input type="checkbox"/> PCB's <input checked="" type="checkbox"/> Congeners <input type="checkbox"/> Aroclors <input checked="" type="checkbox"/> Pesticides/Herbicides 608 <input type="checkbox"/> 8081A <input type="checkbox"/> 8141A <input type="checkbox"/> 8151A <input type="checkbox"/> Chlorophenolics - 8151M Tri <input type="checkbox"/> Tetra <input type="checkbox"/> PCP <input type="checkbox"/> PAHS 8310 <input type="checkbox"/> SIM <input type="checkbox"/> Metals, Total or Dissolved (See list below) Cyanide <input type="checkbox"/> Hex-Chrom <input type="checkbox"/> pH, Cond., Cl, SO <sub>4</sub> , PO <sub>4</sub> , F, NO <sub>2</sub> , NO <sub>3</sub> , BOD, TSS, TDS (circle) NH <sub>3</sub> -N/COD, Total-P, TKN, (TOC) DOC (circle) NO <sub>2</sub> +NO <sub>3</sub> TOX 9020 <input type="checkbox"/> AOX 1650 <input type="checkbox"/> 506 <input type="checkbox"/> Tri-n-butyltin PSEP Grain Size Total Solids Total Sulfides, TVS	
<b>REPORT REQUIREMENTS</b> <input checked="" type="checkbox"/> I. Routine Report: Method Blank, Surrogate, as required <input checked="" type="checkbox"/> II. Report Dup., MS, MSD as required <input type="checkbox"/> III. Data Validation Report (includes all raw data) <input type="checkbox"/> IV. CLP Deliverable Report <input type="checkbox"/> V. EDD						
<b>INVOICE INFORMATION</b> P.O. # 0592004.00 Bill To: Taku Fuji Firm: KJ						
<b>TURNAROUND REQUIREMENTS</b> 24 hr. _____ 48 hr. _____ 5 Day _____ <input checked="" type="checkbox"/> Standard (10-15 working days) Provide FAX Results 2/13/06 Requested Report Date						
<b>RELINQUISHED BY:</b> Signature <i>[Signature]</i> Date/Time 11/27/01 9:00 Printed Name P. THOMAS RMIT Firm KJ						
<b>RECEIVED BY:</b> Signature <i>[Signature]</i> Date/Time 11/28/01 1030 Printed Name _____ Firm _____						
<b>RELINQUISHED BY:</b> Signature _____ Date/Time _____ Printed Name _____ Firm _____						
<b>RECEIVED BY:</b> Signature _____ Date/Time _____ Printed Name _____ Firm _____						
Circle which metals are to be analyzed: Total Metals: Al <input checked="" type="checkbox"/> Sb Ba Be B Ca <input checked="" type="checkbox"/> Cd <input checked="" type="checkbox"/> Co <input checked="" type="checkbox"/> Cr <input checked="" type="checkbox"/> Cu <input checked="" type="checkbox"/> Fe <input checked="" type="checkbox"/> Pb <input checked="" type="checkbox"/> Mg Mn Mo Ni K <input checked="" type="checkbox"/> Ag <input checked="" type="checkbox"/> Na Se Sr Ti Sn V <input checked="" type="checkbox"/> Zn <input checked="" type="checkbox"/> Hg Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn Hg *INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE)						
SPECIAL INSTRUCTIONS/COMMENTS: Please email initial results ASAP 3 COOLERS						



An Employee - Owned Company

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PAGE 2 OF 2 COC #

# CHAIN OF CUSTODY

SR# 106007165

<b>PROJECT NAME</b> Astoria Area - Wide		<b>PROJECT NUMBER</b> 0592004.00					
<b>PROJECT MANAGER</b> Taku Fuji		<b>COMPANY ADDRESS</b> Kenady Jenks Consultants 200 SW Market St., Suite 500 Portland, OR 97201					
<b>CITY/STATE/ZIP</b> Portland, OR 97201		<b>E-MAIL ADDRESS</b> takufuji@kenadyjenks.com					
<b>PHONE #</b> 503-245-4911		<b>FAX #</b> 503-245-4901					
<b>SAMPLER'S SIGNATURE</b> P. Jenkins		<b>DATE</b> 1/27/06					
<b>SAMPLE I.D.</b>	<b>DATE</b>	<b>TIME</b>	<b>LAB I.D.</b>	<b>MATRIX</b>	<b>NUMBER OF CONTAINERS</b>	<b>TESTS REQUESTED</b>	<b>REMARKS</b>
SW-100	1/27/06	1100	8	W	4	<input checked="" type="checkbox"/> Semivolatile Organics by GC/MS 625 <input type="checkbox"/> 8270 <input type="checkbox"/> 8270LL <input type="checkbox"/> <input checked="" type="checkbox"/> Volatile Organics 624 <input type="checkbox"/> 8260 <input type="checkbox"/> 8021 <input type="checkbox"/> BTEX <input checked="" type="checkbox"/> <input type="checkbox"/> Hydrocarbons (*see below) <input type="checkbox"/> Gas <input type="checkbox"/> Diesel <input type="checkbox"/> Oil <input type="checkbox"/> <input type="checkbox"/> Fuel Fingerprint (FIQ) <input type="checkbox"/> NW-HCID Screen <input type="checkbox"/> Oil & Grease/TRPH 1664 HEM <input type="checkbox"/> 1664 SGT <input type="checkbox"/> <input type="checkbox"/> PCB's <input type="checkbox"/> Aroclors <input type="checkbox"/> Congeners <input type="checkbox"/> <input type="checkbox"/> Pesticides/Herbicides 608 <input type="checkbox"/> 8081A <input type="checkbox"/> 8141A <input type="checkbox"/> 8151A <input type="checkbox"/> <input type="checkbox"/> Chlorophenolics - 8151M <input type="checkbox"/> Tri <input type="checkbox"/> Tetra <input type="checkbox"/> PCP <input type="checkbox"/> <input checked="" type="checkbox"/> PAHS 8310 <input checked="" type="checkbox"/> SIM <input checked="" type="checkbox"/> <input type="checkbox"/> Metals, Total or Dissolved (See list below) <input type="checkbox"/> Cyanide <input type="checkbox"/> Hex-Chrom <input type="checkbox"/> <input type="checkbox"/> pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) <input type="checkbox"/> NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3 <input type="checkbox"/> TOX 9020 <input type="checkbox"/> AOX 1650 <input type="checkbox"/> 506 <input type="checkbox"/>	
SW-101		1120	9	1	4	<input checked="" type="checkbox"/> Volatile Organics 624 <input type="checkbox"/> 8260 <input type="checkbox"/> 8021 <input type="checkbox"/> BTEX <input checked="" type="checkbox"/> <input type="checkbox"/> Hydrocarbons (*see below) <input type="checkbox"/> Gas <input type="checkbox"/> Diesel <input type="checkbox"/> Oil <input type="checkbox"/> <input type="checkbox"/> Fuel Fingerprint (FIQ) <input type="checkbox"/> NW-HCID Screen <input type="checkbox"/> Oil & Grease/TRPH 1664 HEM <input type="checkbox"/> 1664 SGT <input type="checkbox"/> <input type="checkbox"/> PCB's <input type="checkbox"/> Aroclors <input type="checkbox"/> Congeners <input type="checkbox"/> <input type="checkbox"/> Pesticides/Herbicides 608 <input type="checkbox"/> 8081A <input type="checkbox"/> 8141A <input type="checkbox"/> 8151A <input type="checkbox"/> <input type="checkbox"/> Chlorophenolics - 8151M <input type="checkbox"/> Tri <input type="checkbox"/> Tetra <input type="checkbox"/> PCP <input type="checkbox"/> <input checked="" type="checkbox"/> PAHS 8310 <input checked="" type="checkbox"/> SIM <input checked="" type="checkbox"/> <input type="checkbox"/> Metals, Total or Dissolved (See list below) <input type="checkbox"/> Cyanide <input type="checkbox"/> Hex-Chrom <input type="checkbox"/> <input type="checkbox"/> pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) <input type="checkbox"/> NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3 <input type="checkbox"/> TOX 9020 <input type="checkbox"/> AOX 1650 <input type="checkbox"/> 506 <input type="checkbox"/>	
SW-102		1140	10	1	4	<input checked="" type="checkbox"/> Volatile Organics 624 <input type="checkbox"/> 8260 <input type="checkbox"/> 8021 <input type="checkbox"/> BTEX <input checked="" type="checkbox"/> <input type="checkbox"/> Hydrocarbons (*see below) <input type="checkbox"/> Gas <input type="checkbox"/> Diesel <input type="checkbox"/> Oil <input type="checkbox"/> <input type="checkbox"/> Fuel Fingerprint (FIQ) <input type="checkbox"/> NW-HCID Screen <input type="checkbox"/> Oil & Grease/TRPH 1664 HEM <input type="checkbox"/> 1664 SGT <input type="checkbox"/> <input type="checkbox"/> PCB's <input type="checkbox"/> Aroclors <input type="checkbox"/> Congeners <input type="checkbox"/> <input type="checkbox"/> Pesticides/Herbicides 608 <input type="checkbox"/> 8081A <input type="checkbox"/> 8141A <input type="checkbox"/> 8151A <input type="checkbox"/> <input type="checkbox"/> Chlorophenolics - 8151M <input type="checkbox"/> Tri <input type="checkbox"/> Tetra <input type="checkbox"/> PCP <input type="checkbox"/> <input checked="" type="checkbox"/> PAHS 8310 <input checked="" type="checkbox"/> SIM <input checked="" type="checkbox"/> <input type="checkbox"/> Metals, Total or Dissolved (See list below) <input type="checkbox"/> Cyanide <input type="checkbox"/> Hex-Chrom <input type="checkbox"/> <input type="checkbox"/> pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) <input type="checkbox"/> NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3 <input type="checkbox"/> TOX 9020 <input type="checkbox"/> AOX 1650 <input type="checkbox"/> 506 <input type="checkbox"/>	
SW-104		1400	11	1	4	<input checked="" type="checkbox"/> Volatile Organics 624 <input type="checkbox"/> 8260 <input type="checkbox"/> 8021 <input type="checkbox"/> BTEX <input checked="" type="checkbox"/> <input type="checkbox"/> Hydrocarbons (*see below) <input type="checkbox"/> Gas <input type="checkbox"/> Diesel <input type="checkbox"/> Oil <input type="checkbox"/> <input type="checkbox"/> Fuel Fingerprint (FIQ) <input type="checkbox"/> NW-HCID Screen <input type="checkbox"/> Oil & Grease/TRPH 1664 HEM <input type="checkbox"/> 1664 SGT <input type="checkbox"/> <input type="checkbox"/> PCB's <input type="checkbox"/> Aroclors <input type="checkbox"/> Congeners <input type="checkbox"/> <input type="checkbox"/> Pesticides/Herbicides 608 <input type="checkbox"/> 8081A <input type="checkbox"/> 8141A <input type="checkbox"/> 8151A <input type="checkbox"/> <input type="checkbox"/> Chlorophenolics - 8151M <input type="checkbox"/> Tri <input type="checkbox"/> Tetra <input type="checkbox"/> PCP <input type="checkbox"/> <input checked="" type="checkbox"/> PAHS 8310 <input checked="" type="checkbox"/> SIM <input checked="" type="checkbox"/> <input type="checkbox"/> Metals, Total or Dissolved (See list below) <input type="checkbox"/> Cyanide <input type="checkbox"/> Hex-Chrom <input type="checkbox"/> <input type="checkbox"/> pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) <input type="checkbox"/> NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3 <input type="checkbox"/> TOX 9020 <input type="checkbox"/> AOX 1650 <input type="checkbox"/> 506 <input type="checkbox"/>	
SW-105		1435	12	1	4	<input checked="" type="checkbox"/> Volatile Organics 624 <input type="checkbox"/> 8260 <input type="checkbox"/> 8021 <input type="checkbox"/> BTEX <input checked="" type="checkbox"/> <input type="checkbox"/> Hydrocarbons (*see below) <input type="checkbox"/> Gas <input type="checkbox"/> Diesel <input type="checkbox"/> Oil <input type="checkbox"/> <input type="checkbox"/> Fuel Fingerprint (FIQ) <input type="checkbox"/> NW-HCID Screen <input type="checkbox"/> Oil & Grease/TRPH 1664 HEM <input type="checkbox"/> 1664 SGT <input type="checkbox"/> <input type="checkbox"/> PCB's <input type="checkbox"/> Aroclors <input type="checkbox"/> Congeners <input type="checkbox"/> <input type="checkbox"/> Pesticides/Herbicides 608 <input type="checkbox"/> 8081A <input type="checkbox"/> 8141A <input type="checkbox"/> 8151A <input type="checkbox"/> <input type="checkbox"/> Chlorophenolics - 8151M <input type="checkbox"/> Tri <input type="checkbox"/> Tetra <input type="checkbox"/> PCP <input type="checkbox"/> <input checked="" type="checkbox"/> PAHS 8310 <input checked="" type="checkbox"/> SIM <input checked="" type="checkbox"/> <input type="checkbox"/> Metals, Total or Dissolved (See list below) <input type="checkbox"/> Cyanide <input type="checkbox"/> Hex-Chrom <input type="checkbox"/> <input type="checkbox"/> pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) <input type="checkbox"/> NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3 <input type="checkbox"/> TOX 9020 <input type="checkbox"/> AOX 1650 <input type="checkbox"/> 506 <input type="checkbox"/>	

<b>REPORT REQUIREMENTS</b>		<b>INVOICE INFORMATION</b>	
<input checked="" type="checkbox"/> I. Routine Report: Method Blank, Surrogate, as required	<b>P.O. #</b> 0592004.00	<b>Bill To:</b> Taku Fuji	
<input checked="" type="checkbox"/> II. Report Dup., MS, MSD as required	<b>TURNAROUND REQUIREMENTS</b>		
<input type="checkbox"/> III. Data Validation Report (includes all raw data)	24 hr. _____ 48 hr. _____		
<input type="checkbox"/> IV. CLP Deliverable Report	5 Day _____		
<input type="checkbox"/> V. EDD	Standard (10-15 working days) _____		
<b>Requested Report Date</b> 2/13/06		<b>Provide FAX Results</b>	

<b>RELINQUISHED BY:</b>	<b>RECEIVED BY:</b>	<b>RELINQUISHED BY:</b>	<b>RECEIVED BY:</b>
Signature: P. Jenkins Date/Time: 1/27/06 9:00 Firm: KJ	Signature: [Signature] Date/Time: 1/27/06 10:30 Firm: KJ	Signature: [Signature] Date/Time: 1/27/06 10:30 Firm: KJ	Signature: [Signature] Date/Time: 1/27/06 10:30 Firm: KJ

**SPECIAL INSTRUCTIONS/COMMENTS:**

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn Hg

\*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: (CIRCLE ONE)

Phase email initial results ASAP

3 coolers

4 feed 4 Top Blenders

**Columbia Analytical Services Inc.  
Cooler Receipt and Preservation Form**

PC Shag

Project/Client Kennedy Leaks Service Request K06 00765

Cooler received on 6/8/06 and opened on 6/8/06 by JA

1. Were custody seals on outside of coolers? ☒ Y ☐ N  
If yes, how many and where? 1 feat each
2. Were custody seals intact? ☒ Y ☐ N
3. Were signature and date present on the custody seals? ☒ Y ☐ N
4. Is the shipper's airbill available and filed? If no, record airbill number: ☒ Y ☐ N
5. COC# ☐ Y ☐ N  

Temperature of cooler(s) upon receipt: (°C)	<u>4.0</u>	<u>3.7</u>	<u>5.4</u>	<u>    </u>
Temperature Blank: (°C)	<u>2.9</u>	<u>2.1</u>	<u>4.4</u>	<u>    </u>
- Were samples hand delivered on the same day as collection? ☒ Y ☐ N
6. Were custody papers properly filled out (ink, signed, etc.)? ☒ Y ☐ N
7. Type of packing material present inserts, sleeves
8. Did all bottles arrive in good condition (unbroken)? ☒ Y ☐ N
9. Were all bottle labels complete (i.e analysis, preservation, etc.)? ☒ Y ☐ N
10. Did all bottle labels and tags agree with custody papers? ☒ Y ☐ N
11. Were the correct types of bottles used for the tests indicated? ☒ Y ☐ N
12. Were all of the preserved bottles received at the lab with the appropriate pH? ☒ Y ☐ N
13. Were VOA vials checked for absence of air bubbles, and if present, noted below? ☒ Y ☐ N
14. Were the 1631 Mercury bottles checked for absence of air bubbles, and if present, noted below? ☒ Y ☐ N
15. Did the bottles originate from CAS/K or a branch laboratory? ☒ Y ☐ N
16. Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection? ☒ Y ☐ N
17. Was C12/Res negative? ☒ Y ☐ N

Explain any discrepancies: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

RESOLUTION: \_\_\_\_\_

Samples that required preservation or received out of temperature:

Sample ID	Reagent	Volume	Lot Number	Bottle Type	Rec'd out of Temperature	Initials

**Total Solids**

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765

## Total Solids

**Prep Method:** NONE  
**Analysis Method:** 160.3M  
**Test Notes:**

**Units:** PERCENT  
**Basis:** Wet

Sample Name	Lab Code	Date Collected	Date Received	Date Analyzed	Result	Result Notes
SD-100	K0600765-001	01/26/2006	01/28/2006	01/30/2006	46.5	
SD-101	K0600765-002	01/26/2006	01/28/2006	01/30/2006	40.9	
SD-102	K0600765-003	01/26/2006	01/28/2006	01/30/2006	27.1	
SD-103	K0600765-004	01/26/2006	01/28/2006	01/30/2006	43.7	
SD-104	K0600765-005	01/26/2006	01/28/2006	01/30/2006	45.1	
REF-EBB	K0600765-006	01/26/2006	01/28/2006	01/30/2006	49.0	
REF-YB	K0600765-007	01/26/2006	01/28/2006	01/30/2006	56.5	



**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Analyzed:** 01/30/2006

**Duplicate Sample Summary  
Total Solids**

**Prep Method:** NONE  
**Analysis Method:** 160.3M  
**Test Notes:**

**Units:** PERCENT  
**Basis:** Wet

Sample Name	Lab Code	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
REF-YB	K0600765-007	56.5	55.4	56.0	2	

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06

## Total Volatile Solids

Prep Method: Method  
Analysis Method: PSEP  
Test Notes:

Units: PERCENT  
Basis: Dry

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Result	Result Notes
SD-100	K0600765-001	-	-	1	02/03/06	02/01/06	6.48	
SD-101	K0600765-002	-	-	1	02/03/06	02/01/06	10.3	
SD-102	K0600765-003	-	-	1	02/03/06	02/01/06	29.2	
SD-103	K0600765-004	-	-	1	02/03/06	02/01/06	6.77	
SD-104	K0600765-005	-	-	1	02/03/06	02/01/06	6.42	
REF-EBB	K0600765-006	-	-	1	02/03/06	02/01/06	5.46	
REF-YB	K0600765-007	-	-	1	02/03/06	02/01/06	4.91	

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

2/3/06

IA/020597p

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765

**Date Collected:** 01/26/06

**Date Received:** 01/28/06

**Date Prepared:** NA

**Date Analyzed:** 02/01/06

Duplicate Summary  
Inorganic Parameters

**Sample Name:** SD-100  
**Lab Code:** K0600765-001DUP  
**Test Notes:**

**Units:** PERCENT

**Basis:** Dry

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Total Volatile Solids	Method	PSEP	-	6.48	6.50	6.49	< 1	

Approved By: \_\_\_\_\_

Date: 2/3/06

DUP/020597p

# COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06  
**Date Prepared:** 02/03/06  
**Date Analyzed:** 02/01/06

### Triplicate Summary Inorganic Parameters

**Sample Name:** SD-100  
**Lab Code:** K0600765-001TRP  
**Test Notes:**

**Units:** PERCENT  
**Basis:** Dry

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Triplicate Sample Result	Average	Relative Standard Deviation	Result Notes
Total Volatile Solids	Method	PSEP	-	6.48	6.50	7.39	6.79	8	

Approved By: \_\_\_\_\_

Date: 2/3/06

DUP:020597p

## **General Chemistry Parameters**

# COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Report

**Client :** Kennedy/Jenks Consultants, Incorporated  
**Project Name :** Astoria Area-Wide  
**Project Number :** 0592004.00  
**Sample Matrix :** SOIL

**Service Request :** K0600765  
**Date Collected :** 01/26/06  
**Date Received :** 01/28/06

### Ammonia as Nitrogen

**Prep Method :** Method  
**Analysis Method :** 350.3  
**Test Notes :**

**Units :** mg/Kg (ppm)  
**Basis :** Dry

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Result	Result Notes
SD-100	K0600765-001	0.5	0.09	1	02/02/06	02/03/05	21.4	
SD-101	K0600765-002	0.5	0.09	1	02/02/06	02/03/05	69.0	
SD-102	K0600765-003	0.5	0.09	1	02/02/06	02/03/05	16.6	
SD-103	K0600765-004	0.5	0.09	1	02/02/06	02/03/05	66.8	
SD-104	K0600765-005	0.5	0.09	1	02/02/06	02/03/05	47.9	
REF-EBB	K0600765-006	0.5	0.09	1	02/02/06	02/03/05	43.3	
REF-YB	K0600765-007	0.5	0.09	1	02/02/06	02/03/05	40.5	
Method Blank	K0600765-MB	0.5	0.09	1	02/03/06	02/03/06	ND	

# COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client :** Kennedy/Jenks Consultants, Incorporated  
**Project Name :** Astoria Area-Wide  
**Project Number :** 0592004.00  
**Sample Matrix :** SOIL

**Service Request :** K0600765  
**Date Collected :** 01/26/06  
**Date Received :** 01/28/06  
**Date Prepared :** 02/02/06  
**Date Analyzed :** 02/03/05

### Duplicate Summary Inorganic Parameters

**Sample Name :** SD-100  
**Lab Code :** K0600765-001DUP  
**Test Notes :**

**Units :** mg/Kg (ppm)  
**Basis :** Dry

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate		Relative Percent Difference	Result Notes
					Sample Result	Average		
Ammonia as Nitrogen	Method	350.3	0.5	21.4	19.6	20.5	9	

# COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client :** Kennedy/Jenks Consultants, Incorporated  
**Project Name :** Astoria Area-Wide  
**Project Number :** 0592004.00  
**Sample Matrix :** SOIL

**Service Request :** K0600765  
**Date Collected :** 01/26/06  
**Date Received :** 01/28/06  
**Date Prepared :** 02/02/06  
**Date Analyzed :** 02/03/05

### Matrix Spike Summary Inorganic Parameters

**Sample Name :** SD-100  
**Lab Code :** K0600765-001MS  
**Test Notes :**

**Units :** mg/Kg (ppm)  
**Basis :** Dry

Analyte	Prep Method	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS	Result Notes
								Percent Recovery Acceptance Limits	
Ammonia as Nitrogen	Method	350.3	0.5	53.2	21.4	67.1	86	75-125	



# COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client :** Kennedy/Jenks Consultants, Incorporated  
**Project Name :** Astoria Area-Wide  
**Project Number :** 0592004.00  
**Sample Matrix :** SOIL

**Service Request :** K0600765  
**Date Collected :** NA  
**Date Received :** NA  
**Date Prepared :** 02/03/06  
**Date Analyzed :** 02/03/06

### Laboratory Control Sample Summary Inorganic Parameters

**Sample Name :** Laboratory Control Sample  
**Lab Code :** K0600765-LCS  
**Test Notes :**

**Units :** mg/Kg (ppm)  
**Basis :** Dry

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS	Result Notes
						Percent Recovery Acceptance Limits	
Ammonia as Nitrogen	Method	350.3	5.2	5.3	102	85-115	

# COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06

### Sulfide, Total

**Prep Method:** Method  
**Analysis Method:** PSEP  
**Test Notes:**

**Units:** mg/Kg (ppm)  
**Basis:** Dry

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Result	Result Notes
SD-100	K0600765-001	180	80	100	02/01/06	02/01/06	1030	
SD-101	K0600765-002	180	80	100	02/01/06	02/01/06	1540	
SD-102	K0600765-003	180	80	100	02/01/06	02/01/06	699	
SD-103	K0600765-004	450	200	250	02/01/06	02/01/06	2340	
SD-104	K0600765-005	180	80	100	02/01/06	02/01/06	1620	
REF-EBB	K0600765-006	180	80	100	02/01/06	02/01/06	1320	
REF-YB	K0600765-007	180	80	100	02/01/06	02/01/06	447	
Method Blank	K0600765-MB	1.8	0.8	1	02/01/06	02/01/06	ND	

Approved By: \_\_\_\_\_

*WJ FJB*

Date: \_\_\_\_\_

*2/13/06*

1A/020597p

K0600765wet.ag1 - Sample 02/13/06

Page No.:

# COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06  
**Date Prepared:** 02/01/06  
**Date Analyzed:** 02/01/06

### Duplicate Summary Inorganic Parameters

**Sample Name:** SD-100  
**Lab Code:** K0600765-001DUP  
**Test Notes:**

**Units:** mg/Kg (ppm)  
**Basis:** Dry

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Sulfide, Total	Method	PSEP	180	1030	832	931	21	

Approved By: MAF Date: 2/13/06

DUP/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06  
**Date Prepared:** 02/01/06  
**Date Analyzed:** 02/01/06

Triplicate Summary  
Inorganic Parameters

**Sample Name:** SD-100  
**Lab Code:** K0600765-001TRP  
**Test Notes:**

**Units:** mg/Kg (ppm)  
**Basis:** Dry

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Triplicate Sample Result	Average	Relative Standard Deviation	Result Notes
Sulfide, Total	Method	PSEP	180	1030	832	840	901	12	

Approved By:                     *M. F. M.*                     Date:           2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06  
**Date Prepared:** 02/01/06  
**Date Analyzed:** 02/01/06

Matrix Spike Summary  
Inorganic Parameters

**Sample Name:** SD-100 **Units:** mg/Kg (ppm)  
**Lab Code:** K0600765-001MS **Basis:** Dry  
**Test Notes:**

Analyte	Prep Method	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS	Result Notes
								Percent Recovery Acceptance Limits	
Sulfide, Total	Method	PSEP	450	1450	1030	2140	77	60-130	

Approved By:                     *MS SA*                     Date:           2/13/06          

MS/020597p

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**LCS Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA  
**Date Prepared:** 02/01/06  
**Date Analyzed:** 02/01/06

Laboratory Control Sample Summary  
 Inorganic Parameters

**Sample Name:** Lab Control Sample  
**Lab Code:** K0600765-LCS  
**Test Notes:**

**Units:** mg/Kg (ppm)  
**Basis:** Dry

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfide, Total	Method	PSEP	322	308	96	60-130	

Approved By: \_\_\_\_\_

*WJF*

Date: \_\_\_\_\_

*2/13/06*

LCS/020597p

# COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06

### Carbon, Total Organic

**Prep Method:** Method  
**Analysis Method:** PSEP  
**Test Notes:**

**Units:** PERCENT  
**Basis:** Dry

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Result	Result Notes
SD-100	K0600765-001	0.05	0.02	1	01/30/06	01/31/06	2.60	
SD-101	K0600765-002	0.05	0.02	1	01/30/06	01/31/06	4.45	
SD-102	K0600765-003	0.05	0.02	1	01/30/06	01/31/06	15.6	
SD-103	K0600765-004	0.05	0.02	1	01/30/06	01/31/06	2.39	
SD-104	K0600765-005	0.05	0.02	1	01/30/06	01/31/06	2.04	
REF-EBB	K0600765-006	0.05	0.02	1	01/30/06	01/31/06	1.72	
REF-YB	K0600765-007	0.05	0.02	1	01/30/06	01/31/06	1.36	
Method Blank	K0600765-MB	0.05	0.02	1	01/30/06	01/31/06	ND	

Approved By: \_\_\_\_\_

*WJF*

Date: \_\_\_\_\_

*2/13/06*

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06  
**Date Prepared:** 01/30/06  
**Date Analyzed:** 01/31/06

Duplicate Summary  
 Inorganic Parameters

**Sample Name:** SD-100  
**Lab Code:** K0600765-001DUP  
**Test Notes:**

**Units:** PERCENT  
**Basis:** Dry

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Carbon, Total Organic	Method	PSEP	0.05	2.60	2.69	2.65	3	

Approved By:  Date: 2/13/06



**COLUMBIA ANALYTICAL SERVICES, INC.**

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06  
**Date Prepared:** 01/30/06  
**Date Analyzed:** 01/31/06

### Triplicate Summary Inorganic Parameters

Sample Name: SD-100  
Lab Code: K0600765-001TRP  
Test Notes:

Units: PERCENT  
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Triplicate Sample Result	Average	Relative Standard Deviation	Result Notes
Carbon, Total Organic	Method	PSEP	0.05	2.60	2.69	2.53	2.61	3	

Approved By: WJF Date: 2/13/06

DUP/020597p  
K0600765WET.AG2 - TRP 02/13/06

Page No.:

**COLUMBIA ANALYTICAL SERVICES, INC.**

**QA/QC Report**

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/06  
**Date Received:** 01/28/06  
**Date Prepared:** 01/30/06  
**Date Analyzed:** 01/31/06

**Matrix Spike Summary  
Inorganic Parameters**

**Sample Name:** SD-100 **Units:** PERCENT  
**Lab Code:** K0600765-001MS **Basis:** Dry  
**Test Notes:**

Analyte	Prep Method	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS	Result Notes
								Percent Recovery Acceptance Limits	
Carbon, Total Organic	Method	PSEP	0.05	9.09	2.60	11.6	99	75-125	

**Approved By:**                     *My F H*                     **Date:**           2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**LCS Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA  
**Date Prepared:** 01/30/06  
**Date Analyzed:** 01/31/06

Laboratory Control Sample Summary  
 Inorganic Parameters

**Sample Name:** Lab Control Sample  
**Lab Code:** K0600765-LCS  
**Test Notes:**

**Units:** PERCENT  
**Basis:** Dry

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Carbon, Total Organic	Method	PSEP	0.75	0.74	99	85-115	

Approved By:                     *MJ F*                     Date: 2/13/06

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** SD-100  
**Lab Code:** K0600765-001

Sand Fraction: Dry Weight (Grams) 5.2545  
 Sand Fraction: Weight Recovered (Grams) 5.2520  
 Sand Fraction: Percent Recovery 100

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.1001	0.68
Very Coarse Sand	-1 to 0 Ø	0.2207	1.49
Coarse Sand	0 to 1 Ø	0.2471	1.67
Medium Sand	1 to 2 Ø	0.4467	3.02
Fine Sand	2 to 3 Ø	1.4607	9.89
Very Fine Sand	3 to 4 Ø	1.8246	12.3
62.5 µm	4 to 5 Ø	3.2100	21.7
31.3 µm	5 to 6 Ø	3.1450	21.3
15.6 µm	6 to 7 Ø	1.7950	12.1
7.8 µm	7 to 8 Ø	0.8900	6.02
3.9 µm	8 to 9 Ø	0.4550	3.08
1.95 µm	9 to 10 Ø	0.2600	1.76
0.98 µm	> 10 Ø	1.1200	7.58
		15.1749	103

Approved By: \_\_\_\_\_



Date: \_\_\_\_\_

2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** SD-100  
**Lab Code:** K0600765-001 DUP

Sand Fraction: Dry Weight (Grams) 5.1916  
 Sand Fraction: Weight Recovered (Grams) 5.1978  
 Sand Fraction: Percent Recovery 100

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.3735	2.64
Very Coarse Sand	-1 to 0 Ø	0.1866	1.32
Coarse Sand	0 to 1 Ø	0.1993	1.41
Medium Sand	1 to 2 Ø	0.3879	2.75
Fine Sand	2 to 3 Ø	1.3604	9.63
Very Fine Sand	3 to 4 Ø	1.8044	12.8
62.5 µm	4 to 5 Ø	3.0750	21.8
31.3 µm	5 to 6 Ø	3.0550	21.6
15.6 µm	6 to 7 Ø	1.7700	12.5
7.8 µm	7 to 8 Ø	0.5350	3.79
3.9 µm	8 to 9 Ø	0.5600	3.96
1.95 µm	9 to 10 Ø	0.3850	2.73
0.98 µm	> 10 Ø	0.8350	5.91
		14.5271	103

Approved By: WJF Date: 2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** SD-100  
**Lab Code:** K0600765-001 TRP

Sand Fraction: Dry Weight (Grams) 5.4433  
 Sand Fraction: Weight Recovered (Grams) 5.4215  
 Sand Fraction: Percent Recovery 99.6

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0953	0.62
Very Coarse Sand	-1 to 0 Ø	0.1780	1.16
Coarse Sand	0 to 1 Ø	0.1749	1.14
Medium Sand	1 to 2 Ø	0.4104	2.68
Fine Sand	2 to 3 Ø	1.4678	9.59
Very Fine Sand	3 to 4 Ø	2.0383	13.3
62.5 µm	4 to 5 Ø	3.5600	23.3
31.3 µm	5 to 6 Ø	3.4200	22.3
15.6 µm	6 to 7 Ø	1.9500	12.7
7.8 µm	7 to 8 Ø	0.4750	3.10
3.9 µm	8 to 9 Ø	0.8200	5.36
1.95 µm	9 to 10 Ø	0.3650	2.38
0.98 µm	> 10 Ø	0.9000	5.88
		15.8547	104

Approved By:                     *MJ F*                     Date:           2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** SD-101  
**Lab Code:** K0600765-002

Sand Fraction: Dry Weight (Grams) 3.5006  
 Sand Fraction: Weight Recovered (Grams) 3.5244  
 Sand Fraction: Percent Recovery 101

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.3774	2.67
Very Coarse Sand	-1 to 0 Ø	0.2272	1.61
Coarse Sand	0 to 1 Ø	0.2186	1.55
Medium Sand	1 to 2 Ø	0.2623	1.85
Fine Sand	2 to 3 Ø	0.4563	3.23
Very Fine Sand	3 to 4 Ø	1.1085	7.84
62.5 µm	4 to 5 Ø	2.5000	17.7
31.3 µm	5 to 6 Ø	3.4950	24.7
15.6 µm	6 to 7 Ø	2.1700	15.3
7.8 µm	7 to 8 Ø	1.3550	9.58
3.9 µm	8 to 9 Ø	1.2050	8.52
1.95 µm	9 to 10 Ø	0.2950	2.09
0.98 µm	> 10 Ø	0.7000	4.95
		14.3703	102

Approved By:                     *WJF*                     Date:           2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** SD-102  
**Lab Code:** K0600765-003

Sand Fraction: Dry Weight (Grams) 5.4724  
 Sand Fraction: Weight Recovered (Grams) 5.4142  
 Sand Fraction: Percent Recovery 98.9

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	2.0845	22.4
Very Coarse Sand	-1 to 0 Ø	0.4973	5.33
Coarse Sand	0 to 1 Ø	0.5333	5.72
Medium Sand	1 to 2 Ø	0.5016	5.38
Fine Sand	2 to 3 Ø	0.6334	6.79
Very Fine Sand	3 to 4 Ø	0.8603	9.22
62.5 µm	4 to 5 Ø	1.0550	11.3
31.3 µm	5 to 6 Ø	1.2000	12.9
15.6 µm	6 to 7 Ø	0.9050	9.70
7.8 µm	7 to 8 Ø	0.5350	5.74
3.9 µm	8 to 9 Ø	0.3500	3.75
1.95 µm	9 to 10 Ø	0.1950	2.09
0.98 µm	> 10 Ø	0.4700	5.04
		9.8204	105

Approved By: WJFA Date: 2/13/06



**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** SD-103  
**Lab Code:** K0600765-004

Sand Fraction: Dry Weight (Grams) 2.6612  
 Sand Fraction: Weight Recovered (Grams) 2.6465  
 Sand Fraction: Percent Recovery 99.4

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0655	0.43
Very Coarse Sand	-1 to 0 Ø	0.0895	0.58
Coarse Sand	0 to 1 Ø	0.0995	0.65
Medium Sand	1 to 2 Ø	0.1229	0.80
Fine Sand	2 to 3 Ø	0.2636	1.71
Very Fine Sand	3 to 4 Ø	0.8836	5.75
62.5 µm	4 to 5 Ø	2.7850	18.1
31.3 µm	5 to 6 Ø	3.9000	25.4
15.6 µm	6 to 7 Ø	2.5450	16.6
7.8 µm	7 to 8 Ø	1.6250	10.6
3.9 µm	8 to 9 Ø	1.4050	9.14
1.95 µm	9 to 10 Ø	0.2950	1.92
0.98 µm	> 10 Ø	0.8100	5.27
		14.8896	96.8

Approved By:  Date: 2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** SD-104  
**Lab Code:** K0600765-005

Sand Fraction: Dry Weight (Grams) 1.7752  
 Sand Fraction: Weight Recovered (Grams) 1.7625  
 Sand Fraction: Percent Recovery 99.3

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0040	0.03
Very Coarse Sand	-1 to 0 Ø	0.0553	0.38
Coarse Sand	0 to 1 Ø	0.0283	0.20
Medium Sand	1 to 2 Ø	0.0298	0.21
Fine Sand	2 to 3 Ø	0.1264	0.87
Very Fine Sand	3 to 4 Ø	0.9371	6.47
62.5 µm	4 to 5 Ø	3.0050	20.8
31.3 µm	5 to 6 Ø	3.6600	25.3
15.6 µm	6 to 7 Ø	2.4850	17.2
7.8 µm	7 to 8 Ø	2.0150	13.9
3.9 µm	8 to 9 Ø	1.2300	8.50
1.95 µm	9 to 10 Ø	0.3450	2.38
0.98 µm	> 10 Ø	0.9150	6.32
		14.8359	103

Approved By: WJ FH Date: 2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** REF-EBB  
**Lab Code:** K0600765-006

Sand Fraction: Dry Weight (Grams) 3.8951  
 Sand Fraction: Weight Recovered (Grams) 3.8809  
 Sand Fraction: Percent Recovery 99.6

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0099	0.05
Coarse Sand	0 to 1 Ø	0.0522	0.28
Medium Sand	1 to 2 Ø	0.0679	0.37
Fine Sand	2 to 3 Ø	0.2458	1.34
Very Fine Sand	3 to 4 Ø	2.1445	11.7
62.5 µm	4 to 5 Ø	4.5450	24.7
31.3 µm	5 to 6 Ø	4.3400	23.6
15.6 µm	6 to 7 Ø	2.7750	15.1
7.8 µm	7 to 8 Ø	2.1200	11.5
3.9 µm	8 to 9 Ø	1.1200	6.10
1.95 µm	9 to 10 Ø	0.3150	1.72
0.98 µm	> 10 Ø	0.8450	4.60
		18.5803	101

Approved By: WV FJH Date: 2/13/06

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

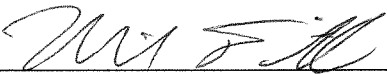
**Service Request:** K0600765  
**Date Collected:** 1/26/2006  
**Date Received:** 1/28/2006  
**Date Analyzed:** 1/30/2006

Particle Size Determination  
 Puget Sound Estuary Program Protocol

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007

Sand Fraction: Dry Weight (Grams) 9.4170  
 Sand Fraction: Weight Recovered (Grams) 9.4036  
 Sand Fraction: Percent Recovery 99.9

Description	Phi Size	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel	<-1 Ø	0.0000	0.00
Very Coarse Sand	-1 to 0 Ø	0.0212	0.09
Coarse Sand	0 to 1 Ø	0.0826	0.34
Medium Sand	1 to 2 Ø	1.0654	4.42
Fine Sand	2 to 3 Ø	3.8106	15.8
Very Fine Sand	3 to 4 Ø	3.4346	14.3
62.5 µm	4 to 5 Ø	3.5350	14.7
31.3 µm	5 to 6 Ø	4.0350	16.8
15.6 µm	6 to 7 Ø	3.1650	13.1
7.8 µm	7 to 8 Ø	1.5700	6.52
3.9 µm	8 to 9 Ø	1.6700	6.93
1.95 µm	9 to 10 Ø	0.9000	3.74
0.98 µm	> 10 Ø	1.5500	6.44
		24.8394	103

Approved By:  Date: 2/13/06

## **Metals**

METALS

- Cover Page -  
INORGANIC ANALYSIS DATA PACKAGE

Client: Kennedy/Jenks Consultants, Incorporated      Service Request: K0600765  
Project No.: 0592004.00  
Project Name: Astoria Area-Wide

<u>Sample No.</u>	<u>Lab Sample ID.</u>
Batch QCD	K0600664-001D
Batch QCS	K0600664-001S
SD-100	K0600765-001
SD-100D	K0600765-001D
SD-100S	K0600765-001S
SD-101	K0600765-002
SD-102	K0600765-003
SD-103	K0600765-004
SD-104	K0600765-005
REF-EBB	K0600765-006
REF-YB	K0600765-007
REF-YBD	K0600765-007D
REF-YBS	K0600765-007S
Method Blank	K0600765-MB

Were ICP interelement corrections applied?      Yes/No YES

Were ICP background corrections applied?      Yes/No YES

    If yes-were raw data generated before  
    application of background corrections?      Yes/No NO

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature:       Date: 2/13/06

**METALS**

-1-

**INORGANIC ANALYSIS DATA SHEET**

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected: 01/26/06

Project Name: Astoria Area-Wide

Date Received: 01/28/06

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: SD-100

Lab Code: K0600765-001

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.49	0.08	5	1/31/06	2/9/06	3.34		
Cadmium	6020	0.049	0.007	5	1/31/06	2/9/06	0.420		
Chromium	6020	0.20	0.04	5	1/31/06	2/9/06	13.2		
Copper	6020	0.10	0.04	5	1/31/06	2/9/06	21.0		
Lead	6020	0.05	0.02	5	1/31/06	2/9/06	14.4		
Mercury	7471A	0.019	0.009	1	2/1/06	2/6/06	0.073		
Silver	6020	0.020	0.002	5	2/1/06	2/7/06	0.117		
Zinc	6020	0.49	0.20	5	1/31/06	2/9/06	72.2		

% Solids: 46.5

Comments:

## METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected: 01/26/06

Project Name: Astoria Area-Wide

Date Received: 01/28/06

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: SD-101

Lab Code: K0600765-002

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.46	0.07	5	1/31/06	2/9/06	6.97		
Cadmium	6020	0.046	0.006	5	1/31/06	2/9/06	0.498		
Chromium	6020	0.18	0.04	5	1/31/06	2/9/06	15.0		
Copper	6020	0.09	0.04	5	1/31/06	2/9/06	33.6		
Lead	6020	0.05	0.02	5	1/31/06	2/9/06	17.8		
Mercury	7471A	0.017	0.008	1	2/1/06	2/6/06	0.100		
Silver	6020	0.018	0.002	5	2/1/06	2/7/06	0.122		
Zinc	6020	2.28	0.91	25	1/31/06	2/9/06	144		

% Solids: 40.9

Comments:



## METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected: 01/26/06

Project Name: Astoria Area-Wide

Date Received: 01/28/06

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: SD-102

Lab Code: K0600765-003

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.61	0.10	5	1/31/06	2/9/06	8.24		
Cadmium	6020	0.061	0.009	5	1/31/06	2/9/06	0.472		
Chromium	6020	0.25	0.05	5	1/31/06	2/9/06	17.6		
Copper	6020	0.12	0.05	5	1/31/06	2/9/06	55.0		
Lead	6020	0.06	0.02	5	1/31/06	2/9/06	25.4		
Mercury	7471A	0.019	0.009	1	2/1/06	2/6/06	0.079		
Silver	6020	0.024	0.002	5	2/1/06	2/7/06	0.098		
Zinc	6020	3.06	1.23	25	1/31/06	2/9/06	218		

% Solids: 27.1

Comments:

## METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected: 01/26/06

Project Name: Astoria Area-Wide

Date Received: 01/28/06

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: SD-103

Lab Code: K0600765-004

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.52	0.08	5	1/31/06	2/9/06	4.41		
Cadmium	6020	0.052	0.007	5	1/31/06	2/9/06	0.578		
Chromium	6020	0.21	0.04	5	1/31/06	2/9/06	15.0		
Copper	6020	0.10	0.04	5	1/31/06	2/9/06	31.0		
Lead	6020	0.05	0.02	5	1/31/06	2/9/06	15.0		
Mercury	7471A	0.020	0.009	1	2/1/06	2/6/06	0.095		
Silver	6020	0.021	0.002	5	2/1/06	2/7/06	0.133		
Zinc	6020	0.52	0.21	5	1/31/06	2/9/06	81.2		

% Solids: 43.7

Comments:

## METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected: 01/26/06

Project Name: Astoria Area-Wide

Date Received: 01/28/06

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: SD-104

Lab Code: K0600765-005

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.08	5	1/31/06	2/9/06	4.45		
Cadmium	6020	0.050	0.007	5	1/31/06	2/9/06	0.593		
Chromium	6020	0.20	0.04	5	1/31/06	2/9/06	14.9		
Copper	6020	0.10	0.04	5	1/31/06	2/9/06	27.7		
Lead	6020	0.05	0.02	5	1/31/06	2/9/06	13.7		
Mercury	7471A	0.019	0.009	1	2/1/06	2/6/06	0.120		
Silver	6020	0.020	0.002	5	2/1/06	2/7/06	0.142		
Zinc	6020	0.50	0.20	5	1/31/06	2/9/06	78.9		

% Solids: 45.1

Comments:

## METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected: 01/26/06

Project Name: Astoria Area-Wide

Date Received: 01/28/06

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: REF-EBB

Lab Code: K0600765-006

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.46	0.07	5	1/31/06	2/9/06	3.22		
Cadmium	6020	0.046	0.006	5	1/31/06	2/9/06	0.407		
Chromium	6020	0.18	0.04	5	1/31/06	2/9/06	11.7		
Copper	6020	0.09	0.04	5	1/31/06	2/9/06	20.9		
Lead	6020	0.05	0.02	5	1/31/06	2/9/06	10.8		
Mercury	7471A	0.020	0.009	1	2/1/06	2/6/06	0.194		
Silver	6020	0.019	0.002	5	2/1/06	2/7/06	0.121		
Zinc	6020	0.46	0.18	5	1/31/06	2/9/06	62.5		

% Solids: 49.0

Comments:

**METALS**

-1-

**INORGANIC ANALYSIS DATA SHEET**

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected: 01/26/06

Project Name: Astoria Area-Wide

Date Received: 01/28/06

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: REF-YB

Lab Code: K0600765-007

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.08	5	1/31/06	2/9/06	4.80		
Cadmium	6020	0.050	0.007	5	1/31/06	2/9/06	0.759		
Chromium	6020	0.20	0.04	5	1/31/06	2/9/06	15.7		
Copper	6020	0.10	0.04	5	1/31/06	2/9/06	20.3		
Lead	6020	0.05	0.02	5	1/31/06	2/9/06	19.4		
Mercury	7471A	0.019	0.008	1	2/1/06	2/6/06	0.178		
Silver	6020	0.020	0.002	5	2/1/06	2/7/06	0.155		
Zinc	6020	0.50	0.20	5	1/31/06	2/9/06	85.8		

% Solids: 56.5

Comments:

## METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Date Collected:

Project Name: Astoria Area-Wide

Date Received:

Matrix: SOIL

Units: MG/KG

Basis: Dry

Sample Name: Method Blank

Lab Code: K0600765-MB

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.08	5	1/31/06	2/9/06	0.08	U	
Cadmium	6020	0.050	0.007	5	1/31/06	2/9/06	0.007	U	
Chromium	6020	0.20	0.04	5	1/31/06	2/9/06	0.12	B	
Copper	6020	0.10	0.04	5	1/31/06	2/9/06	0.04	U	
Lead	6020	0.05	0.02	5	1/31/06	2/9/06	0.02	U	
Mercury	7471A	0.020	0.009	1	2/1/06	2/6/06	0.009	U	
Silver	6020	0.020	0.002	5	2/1/06	2/7/06	0.002	U	
Zinc	6020	0.50	0.20	5	1/31/06	2/9/06	0.20	U	

% Solids: 100.0

Comments:

METALS  
- 5a -  
SPIKE SAMPLE RECOVERY

Client: Kennedy/Jenks Consultants, Incorporated      Service Request: K0600765  
Project No.: 0592004.00      Units: mg/kg  
Project Name: Astoria Area-Wide      Basis: Dry  
Matrix: SOIL      % Solids: 94.6

Sample Name: Batch QCS      Lab Code: K0600664-001S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Mercury	61 - 129	0.451		0.009	U	0.492	92		7471A

An empty field in the Control Limit column indicates the control limit is not applicable.

METALS  
- 5a -  
SPIKE SAMPLE RECOVERY

Client: Kennedy/Jenks Consultants, Incorporated      Service Request: K0600765  
Project No.: 0592004.00      Units: mg/kg  
Project Name: Astoria Area-Wide      Basis: Dry  
Matrix: SOIL      % Solids: 56.5

Sample Name: REF-YBS      Lab Code: K0600765-007S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Silver	70 - 130	9.530		0.155		9.780	96		6020

An empty field in the Control Limit column indicates the control limit is not applicable.



METALS  
- 5a -  
SPIKE SAMPLE RECOVERY

Client: Kennedy/Jenks Consultants, Incorporated      Service Request: K0600765  
Project No.: 0592004.00      Units: mg/kg  
Project Name: Astoria Area-Wide      Basis: Dry  
Matrix: SOIL      % Solids: 46.5

Sample Name: SD-100S      Lab Code: K0600765-001S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	70 - 122	96.0		3.34		98.2	94		6020
Cadmium	77 - 122	10.5		0.420		9.820	103		6020
Chromium	67 - 138	56.3		13.2		39.3	110		6020
Copper	50 - 142	73.4		21.0		49.1	107		6020
Lead	74 - 117	121		14.4		98.2	108		6020
Zinc	51 - 153	186		72.2		98.2	116		6020

An empty field in the Control Limit column indicates the control limit is not applicable.

METALS

- 6 -

DUPLICATES

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Units: mg/kg

Project Name: Astoria Area-Wide

Basis: Dry

Matrix: SOIL

% Solids: 94.6

Sample Name:Batch QCD

Lab Code: K0600664-001D

Analyte	Control Limit (%)	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Mercury		0.009	U	0.009	U			7471A

An empty field in the Control Limit column indicates the control limit is not applicable.

METALS

- 6 -  
DUPLICATES

Client: Kennedy/Jenks Consultants, Incorporated      Service Request: K0600765  
Project No.: 0592004.00      Units: mg/kg  
Project Name: Astoria Area-Wide      Basis: Dry  
Matrix: SOIL      % Solids: 56.5

Sample Name: REF-YBD      Lab Code: K0600765-007D

Analyte	Control Limit (%)	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Silver	30	0.155		0.147		5		6020

An empty field in the Control Limit column indicates the control limit is not applicable.

METALS

- 6 -

DUPLICATES

Client: Kennedy/Jenks Consultants, Incorporated

Service Request: K0600765

Project No.: 0592004.00

Units: mg/kg

Project Name: Astoria Area-Wide

Basis: Dry

Matrix: SOIL

% Solids: 46.5

Sample Name:SD-100D

Lab Code: K0600765-001D

Analyte	Control Limit (%)	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic	30	3.34		3.93		16		6020
Cadmium	30	0.420		0.496		17		6020
Chromium	30	13.2		13.4		2		6020
Copper	30	21.0		24.9		17		6020
Lead	30	14.4		18.0		22		6020
Zinc	30	72.2		83.8		15		6020

An empty field in the Control Limit column indicates the control limit is not applicable.

METALS  
- 7 -  
LABORATORY CONTROL SAMPLE

Client: Kennedy/Jenks Consultants, Incorporated      Service Request: K0600765  
Project No.: 0592004.00  
Project Name: Astoria Area-Wide

Aqueous LCS Source: Inorganic Ventures      Solid LCS Source: ERA Lot #D045540

Analyte	Aqueous mg/L			Solid (mg/kg)				
	True	Found	%R	True	Found	C	Limits	%R
Arsenic				146	144		112	99
Cadmium				92.8	93.9		73.9	101
Chromium				172	175		135	102
Copper				67.0	70.2		53.8	105
Lead				67.5	69.9		53.1	104
Mercury				1.77	1.68		1.21	95
Silver				93.0	91.6		57.0	98
Zinc				380	410		300	108

## **Butyltins**

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Butyltins (as cation)

**Sample Name:** SD-100  
**Lab Code:** K0600765-001  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	4.5		2.2	0.13	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	76	10-127	02/09/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Butyltins (as cation)

**Sample Name:** SD-101  
**Lab Code:** K0600765-002  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	ND	U	2.5	0.14	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	62	10-127	02/09/06	Acceptable

Comments: \_\_\_\_\_



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Butyltins (as cation)

**Sample Name:** SD-102  
**Lab Code:** K0600765-003  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	ND	Ui	3.7	3.7	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	69	10-127	02/09/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Butyltins (as cation)

**Sample Name:** SD-103  
**Lab Code:** K0600765-004  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	4.3		2.3	0.13	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	86	10-127	02/09/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Butyltins (as cation)

**Sample Name:** SD-104  
**Lab Code:** K0600765-005  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	6.0		2.3	0.13	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	82	10-127	02/09/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Butyltins (as cation)

**Sample Name:** REF-EBB  
**Lab Code:** K0600765-006  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	6.5		2.1	0.12	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	85	10-127	02/09/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Butyltins (as cation)

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	2.1		1.8	0.10	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	74	10-127	02/09/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Butyltins (as cation)

**Sample Name:** Method Blank  
**Lab Code:** KWG0602239-4  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tri-n-butyltin	0.24	J	1.0	0.056	1	02/06/06	02/09/06	KWG0602239	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	81	10-127	02/09/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765

**Surrogate Recovery Summary**  
**Butyltins (as cation)**

**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** PERCENT  
**Level:** Low

<u>Sample Name</u>	<u>Lab Code</u>	<u>Sur1</u>
SD-100	K0600765-001	76
SD-101	K0600765-002	62
SD-102	K0600765-003	69
SD-103	K0600765-004	86
SD-104	K0600765-005	82
REF-EBB	K0600765-006	85
REF-YB	K0600765-007	74
Method Blank	KWG0602239-4	81
REF-YBMS	KWG0602239-1	69
REF-YBDMS	KWG0602239-2	68
Lab Control Sample	KWG0602239-3	91

**Surrogate Recovery Control Limits (%)**

---

Sur1 = Tri-n-propyltin 10-127

---

Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

## COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Extracted:** 02/06/2006  
**Date Analyzed:** 02/09/2006

**Matrix Spike/Duplicate Matrix Spike Summary**  
**Butyltins (as cation)**

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007  
**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low  
**Extraction Lot:** KWG0602239

Analyte Name	Sample Result	REF-YBMS KWG0602239-1 Matrix Spike			REF-YBDMS KWG0602239-2 Duplicate Matrix Spike			%Rec Limits	RPD	RPD Limit
		Result	Expected	%Rec	Result	Expected	%Rec			
Tri-n-butyltin	2.1	26.3	39.2	62	23.7	39.3	55	10-140	11	50

Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.



## COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Extracted:** 02/06/2006  
**Date Analyzed:** 02/09/2006

**Lab Control Spike Summary**  
**Butyltins (as cation)**

**Extraction Method:** METHOD  
**Analysis Method:** Krone

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low  
**Extraction Lot:** KWG0602239

Analyte Name	Lab Control Sample KWG0602239-3 Lab Control Spike			%Rec Limits
	Result	Expected	%Rec	
Tri-n-butyltin	19.1	22.2	86	13-125

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Polychlorinated Biphenyls**  
**PCB's**  
**EPA Method 8082**

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** SD-100  
**Lab Code:** K0600765-001  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	Ui	10	7.1	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	Ui	20	4.4	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	Ui	10	5.4	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	U	10	3.5	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1248	ND	Ui	10	9.1	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1254</b>	<b>25</b>	<b>P</b>	10	3.5	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1260</b>	<b>21</b>		10	3.5	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	62	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** SD-101  
**Lab Code:** K0600765-002  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	Ui	10	8.0	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	U	20	4.0	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	Ui	12	12	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	Ui	10	5.7	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1248	ND	Ui	16	16	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1254</b>	<b>27</b>	<b>P</b>	10	4.0	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1260</b>	<b>31</b>		10	4.0	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	59	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** SD-102  
**Lab Code:** K0600765-003  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	Ui	15	15	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	U	30	6.0	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	Ui	19	19	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	Ui	15	15	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1248	ND	Ui	22	22	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1254</b>	<b>69</b>	P	15	6.0	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1260</b>	<b>66</b>		15	6.0	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	61	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** SD-103  
**Lab Code:** K0600765-004  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	3.7	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	U	20	3.7	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	U	10	3.7	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	U	10	3.7	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1248	ND	U	10	3.7	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1254</b>	<b>9.1</b>	<b>JP</b>	10	3.7	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1260</b>	<b>8.4</b>	<b>J</b>	10	3.7	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	54	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** SD-104  
**Lab Code:** K0600765-005  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	3.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	U	20	3.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	U	10	3.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	U	10	3.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1248	ND	U	10	3.6	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1254</b>	<b>6.1</b>	<b>J</b>	10	3.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	ND	U	10	3.6	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	55	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** REF-EBB  
**Lab Code:** K0600765-006  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	3.3	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	U	20	3.3	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	U	10	3.3	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	U	10	3.3	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1248	ND	U	10	3.3	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1254	ND	U	10	3.3	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	ND	U	10	3.3	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	57	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	10	2.9	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	U	20	2.9	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	U	10	2.9	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	U	10	2.9	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1248</b>	<b>13</b>		10	2.9	1	01/31/06	02/03/06	KWG0601729	
<b>Aroclor 1254</b>	<b>10</b>	JP	10	2.9	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	ND	U	10	2.9	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	59	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Polychlorinated Biphenyls (PCBs)

**Sample Name:** Method Blank  
**Lab Code:** KWG0601729-4  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Aroclor 1016	ND	U	4.0	1.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1221	ND	U	8.0	1.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1232	ND	U	4.0	1.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1242	ND	U	4.0	1.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1248	ND	U	4.0	1.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1254	ND	U	4.0	1.6	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	ND	U	4.0	1.6	1	01/31/06	02/03/06	KWG0601729	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Decachlorobiphenyl	65	20-161	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765

**Surrogate Recovery Summary**  
**Polychlorinated Biphenyls (PCBs)**

**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** PERCENT  
**Level:** Low

<u>Sample Name</u>	<u>Lab Code</u>	<u>Sur1</u>
SD-100	K0600765-001	62
SD-101	K0600765-002	59
SD-102	K0600765-003	61
SD-103	K0600765-004	54
SD-104	K0600765-005	55
REF-EBB	K0600765-006	57
REF-YB	K0600765-007	59
Method Blank	KWG0601729-4	65
REF-YBMS	KWG0601729-1	59
REF-YBDMS	KWG0601729-2	60
Lab Control Sample	KWG0601729-3	65

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**Surrogate Recovery Control Limits (%)**

Sur1 = Decachlorobiphenyl 20-161

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Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Extracted:** 01/31/2006  
**Date Analyzed:** 02/03/2006

**Matrix Spike/Duplicate Matrix Spike Summary**  
**Polychlorinated Biphenyls (PCBs)**

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007  
**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low  
**Extraction Lot:** KWG0601729

Analyte Name	Sample Result	REF-YBMS KWG0601729-1 Matrix Spike			REF-YBDMS KWG0601729-2 Duplicate Matrix Spike			%Rec Limits	RPD	RPD Limit
		Result	Expected	%Rec	Result	Expected	%Rec			
Aroclor 1016	ND	176	200	88	171	200	85	33-155	3	50
Aroclor 1260	ND	177	200	89	171	200	86	36-161	4	50

Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Extracted:** 01/31/2006  
**Date Analyzed:** 02/03/2006

**Lab Control Spike Summary**  
**Polychlorinated Biphenyls (PCBs)**

**Extraction Method:** EPA 3540C  
**Analysis Method:** 8082

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low  
**Extraction Lot:** KWG0601729

Analyte Name	Lab Control Sample KWG0601729-3 Lab Control Spike			%Rec Limits
	Result	Expected	%Rec	
Aroclor 1016	143	200	71	43-141
Aroclor 1260	182	200	91	50-145

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Volatile Organic Compounds**  
**EPA Method 8260B**

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Volatile Organics by GC/MS

**Sample Name:** SW-100  
**Lab Code:** K0600765-008  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.14	1	02/07/06	02/07/06	KWG0602100	
Toluene	0.12	J	0.50	0.11	1	02/07/06	02/07/06	KWG0602100	
Ethylbenzene	ND	U	0.50	0.13	1	02/07/06	02/07/06	KWG0602100	
m,p-Xylenes	ND	U	0.50	0.22	1	02/07/06	02/07/06	KWG0602100	
o-Xylene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602100	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Toluene-d8	103	83-113	02/07/06	Acceptable
Dibromofluoromethane	92	80-119	02/07/06	Acceptable
4-Bromofluorobenzene	94	72-114	02/07/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Volatile Organics by GC/MS

**Sample Name:** SW-101  
**Lab Code:** K0600765-009  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	0.61		0.50	0.14	1	02/07/06	02/07/06	KWG0602100	
Toluene	2.7		0.50	0.11	1	02/07/06	02/07/06	KWG0602100	
Ethylbenzene	0.47	J	0.50	0.13	1	02/07/06	02/07/06	KWG0602100	
m,p-Xylenes	1.9		0.50	0.22	1	02/07/06	02/07/06	KWG0602100	
o-Xylene	0.74		0.50	0.11	1	02/07/06	02/07/06	KWG0602100	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Toluene-d8	102	83-113	02/07/06	Acceptable
Dibromofluoromethane	92	80-119	02/07/06	Acceptable
4-Bromofluorobenzene	97	72-114	02/07/06	Acceptable

Comments:



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Volatile Organics by GC/MS

**Sample Name:** SW-102  
**Lab Code:** K0600765-010  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	0.89		0.50	0.14	1	02/07/06	02/07/06	KWG0602100	
Toluene	3.9		0.50	0.11	1	02/07/06	02/07/06	KWG0602100	
Ethylbenzene	0.68		0.50	0.13	1	02/07/06	02/07/06	KWG0602100	
m,p-Xylenes	2.7		0.50	0.22	1	02/07/06	02/07/06	KWG0602100	
o-Xylene	1.0		0.50	0.11	1	02/07/06	02/07/06	KWG0602100	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Toluene-d8	103	83-113	02/07/06	Acceptable
Dibromofluoromethane	93	80-119	02/07/06	Acceptable
4-Bromofluorobenzene	95	72-114	02/07/06	Acceptable

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Volatile Organics by GC/MS

**Sample Name:** SW-104  
**Lab Code:** K0600765-011  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.14	1	02/07/06	02/07/06	KWG0602222	
Toluene	0.12	J	0.50	0.11	1	02/07/06	02/07/06	KWG0602222	
Ethylbenzene	ND	U	0.50	0.13	1	02/07/06	02/07/06	KWG0602222	
m,p-Xylenes	ND	U	0.50	0.22	1	02/07/06	02/07/06	KWG0602222	
o-Xylene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602222	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Toluene-d8	102	83-113	02/07/06	Acceptable
Dibromofluoromethane	89	80-119	02/07/06	Acceptable
4-Bromofluorobenzene	95	72-114	02/07/06	Acceptable

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Volatile Organics by GC/MS

**Sample Name:** SW-105  
**Lab Code:** K0600765-012  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.14	1	02/07/06	02/07/06	KWG0602222	
Toluene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602222	
Ethylbenzene	ND	U	0.50	0.13	1	02/07/06	02/07/06	KWG0602222	
m,p-Xylenes	ND	U	0.50	0.22	1	02/07/06	02/07/06	KWG0602222	
o-Xylene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602222	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Toluene-d8	101	83-113	02/07/06	Acceptable
Dibromofluoromethane	90	80-119	02/07/06	Acceptable
4-Bromofluorobenzene	93	72-114	02/07/06	Acceptable

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Volatile Organics by GC/MS

**Sample Name:** Method Blank  
**Lab Code:** KWG0602100-4  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.14	1	02/07/06	02/07/06	KWG0602100	
Toluene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602100	
Ethylbenzene	ND	U	0.50	0.13	1	02/07/06	02/07/06	KWG0602100	
m,p-Xylenes	ND	U	0.50	0.22	1	02/07/06	02/07/06	KWG0602100	
o-Xylene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602100	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Toluene-d8	101	83-113	02/07/06	Acceptable
Dibromofluoromethane	89	80-119	02/07/06	Acceptable
4-Bromofluorobenzene	96	72-114	02/07/06	Acceptable

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Volatile Organics by GC/MS

**Sample Name:** Method Blank  
**Lab Code:** KWG0602222-4  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.14	1	02/07/06	02/07/06	KWG0602222	
Toluene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602222	
Ethylbenzene	ND	U	0.50	0.13	1	02/07/06	02/07/06	KWG0602222	
m,p-Xylenes	ND	U	0.50	0.22	1	02/07/06	02/07/06	KWG0602222	
o-Xylene	ND	U	0.50	0.11	1	02/07/06	02/07/06	KWG0602222	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Toluene-d8	102	83-113	02/07/06	Acceptable
Dibromofluoromethane	90	80-119	02/07/06	Acceptable
4-Bromofluorobenzene	94	72-114	02/07/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765

**Surrogate Recovery Summary**  
**Volatile Organics by GC/MS**

**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** PERCENT  
**Level:** Low

<u>Sample Name</u>	<u>Lab Code</u>	<u>Sur1</u>	<u>Sur2</u>	<u>Sur3</u>
SW-100	K0600765-008	103	92	94
SW-101	K0600765-009	102	92	97
SW-102	K0600765-010	103	93	95
SW-104	K0600765-011	102	89	95
SW-105	K0600765-012	101	90	93
Method Blank	KWG0602100-4	101	89	96
Method Blank	KWG0602222-4	102	90	94
Batch QC	K0600749-001	103	90	92
Batch QCMS	KWG0602100-1	106	96	97
Batch QCDMS	KWG0602100-2	106	97	98
Lab Control Sample	KWG0602100-3	106	98	97
Lab Control Sample	KWG0602222-3	107	95	97

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**Surrogate Recovery Control Limits (%)**

Sur1 = Toluene-d8	83-113
Sur2 = Dibromofluoromethane	80-119
Sur3 = 4-Bromofluorobenzene	72-114

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Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Extracted:** 02/07/2006  
**Date Analyzed:** 02/07/2006

**Matrix Spike/Duplicate Matrix Spike Summary**  
**Volatile Organics by GC/MS**

**Sample Name:** Batch QC  
**Lab Code:** K0600749-001  
**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low  
**Extraction Lot:** KWG0602100

Analyte Name	Sample Result	Batch QCMS KWG0602100-1 Matrix Spike			Batch QCDMS KWG0602100-2 Duplicate Matrix Spike			%Rec Limits	RPD	RPD Limit
		Result	Expected	%Rec	Result	Expected	%Rec			
Benzene	ND	10.3	10.0	103	10.3	10.0	103	75-130	1	30
Toluene	ND	9.71	10.0	97	9.70	10.0	97	72-132	0	30
Ethylbenzene	ND	8.74	10.0	87	8.79	10.0	88	83-130	1	30
m,p-Xylenes	ND	17.3	20.0	86	17.5	20.0	87	84-132	1	30
o-Xylene	ND	8.64	10.0	86	8.85	10.0	89	83-128	2	30

Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Extracted:** 02/07/2006  
**Date Analyzed:** 02/07/2006

**Lab Control Spike Summary**  
**Volatile Organics by GC/MS**

**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low  
**Extraction Lot:** KWG0602100

Analyte Name	Lab Control Sample KWG0602100-3 Lab Control Spike			%Rec Limits
	Result	Expected	%Rec	
Benzene	10.7	10.0	107	78-121
Toluene	9.81	10.0	98	76-122
Ethylbenzene	8.80	10.0	88	84-122
m,p-Xylenes	18.0	20.0	90	83-125
o-Xylene	8.93	10.0	89	83-122

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.



## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Extracted:** 02/07/2006  
**Date Analyzed:** 02/07/2006

**Lab Control Spike Summary**  
**Volatile Organics by GC/MS**

**Extraction Method:** EPA 5030B  
**Analysis Method:** 8260B

**Units:** ug/L  
**Basis:** NA  
**Level:** Low  
**Extraction Lot:** KWG0602222

Analyte Name	Lab Control Sample KWG0602222-3 Lab Control Spike			%Rec Limits
	Result	Expected	%Rec	
Benzene	10.2	10.0	102	78-121
Toluene	9.34	10.0	93	76-122
Ethylbenzene	8.25	10.0	83 *	84-122
m,p-Xylenes	16.6	20.0	83	83-125
o-Xylene	8.48	10.0	85	83-122

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Semi-Volatile Organic Compounds**  
**EPA Method 8270C**

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-100  
**Lab Code:** K0600765-001  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	11	5.2	1	02/02/06	02/14/06	KWG0601824	
<b>Phenol</b>	15	J	33	4.1	1	02/02/06	02/14/06	KWG0601824	
2-Chlorophenol	ND	U	11	3.7	1	02/02/06	02/14/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	11	3.5	1	02/02/06	02/14/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	11	4.1	1	02/02/06	02/14/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	11	2.8	1	02/02/06	02/14/06	KWG0601824	
Benzyl Alcohol	ND	U	11	8.0	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	11	2.6	1	02/02/06	02/14/06	KWG0601824	
2-Methylphenol	ND	U	11	7.4	1	02/02/06	02/14/06	KWG0601824	
Hexachloroethane	ND	U	11	4.8	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	11	6.9	1	02/02/06	02/14/06	KWG0601824	
4-Methylphenol†	ND	U	11	6.3	1	02/02/06	02/14/06	KWG0601824	
Nitrobenzene	ND	U	11	4.4	1	02/02/06	02/14/06	KWG0601824	
Isophorone	ND	U	11	3.5	1	02/02/06	02/14/06	KWG0601824	
2-Nitrophenol	ND	U	11	5.6	1	02/02/06	02/14/06	KWG0601824	
2,4-Dimethylphenol	ND	U	54	12	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	11	2.8	1	02/02/06	02/14/06	KWG0601824	
2,4-Dichlorophenol	ND	U	11	3.9	1	02/02/06	02/14/06	KWG0601824	
Benzoic Acid	ND	U	220	210	1	02/02/06	02/14/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	11	3.3	1	02/02/06	02/14/06	KWG0601824	
<b>Naphthalene</b>	7.1	J	11	2.8	1	02/02/06	02/14/06	KWG0601824	
4-Chloroaniline	ND	U	11	4.6	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobutadiene	ND	U	11	3.1	1	02/02/06	02/14/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	11	4.6	1	02/02/06	02/14/06	KWG0601824	
2-Methylnaphthalene	ND	U	11	2.6	1	02/02/06	02/14/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	54	33	1	02/02/06	02/14/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	11	3.9	1	02/02/06	02/14/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	11	6.5	1	02/02/06	02/14/06	KWG0601824	
2-Chloronaphthalene	ND	U	11	7.8	1	02/02/06	02/14/06	KWG0601824	
2-Nitroaniline	ND	U	22	5.9	1	02/02/06	02/14/06	KWG0601824	
Acenaphthylene	ND	U	11	3.1	1	02/02/06	02/14/06	KWG0601824	
Dimethyl Phthalate	ND	U	11	3.9	1	02/02/06	02/14/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	11	6.1	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-100  
**Lab Code:** K0600765-001  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	ND	U	11	2.2	1	02/02/06	02/14/06	KWG0601824	
3-Nitroaniline	ND	U	22	5.6	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrophenol	ND	U	220	78	1	02/02/06	02/14/06	KWG0601824	
Dibenzofuran	ND	U	11	2.8	1	02/02/06	02/14/06	KWG0601824	
4-Nitrophenol	ND	U	110	65	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	11	6.1	1	02/02/06	02/14/06	KWG0601824	
Fluorene	ND	U	11	3.7	1	02/02/06	02/14/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	11	4.4	1	02/02/06	02/14/06	KWG0601824	
Diethyl Phthalate	ND	U	11	7.6	1	02/02/06	02/14/06	KWG0601824	
4-Nitroaniline	ND	U	22	7.4	1	02/02/06	02/14/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	110	3.7	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	11	4.8	1	02/02/06	02/14/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	1100	310	100	02/02/06	02/15/06	KWG0601824	
Hexachlorobenzene	ND	U	1100	460	100	02/02/06	02/15/06	KWG0601824	
Pentachlorophenol	ND	U	11000	1900	100	02/02/06	02/15/06	KWG0601824	
Phenanthrene	ND	U	1100	280	100	02/02/06	02/15/06	KWG0601824	
Anthracene	ND	U	1100	310	100	02/02/06	02/15/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	1100	560	100	02/02/06	02/15/06	KWG0601824	
<b>Fluoranthene</b>	<b>650</b>	<b>JD</b>	1100	480	100	02/02/06	02/15/06	KWG0601824	
<b>Pyrene</b>	<b>290</b>		11	2.8	1	02/02/06	02/14/06	KWG0601824	
Butyl Benzyl Phthalate	ND	U	11	3.3	1	02/02/06	02/14/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	110	8.0	1	02/02/06	02/14/06	KWG0601824	
<b>Benz(a)anthracene</b>	<b>120</b>		11	3.1	1	02/02/06	02/14/06	KWG0601824	
<b>Chrysene</b>	<b>210</b>		11	3.1	1	02/02/06	02/14/06	KWG0601824	
<b>Bis(2-ethylhexyl) Phthalate</b>	<b>140</b>	<b>J</b>	220	3.7	1	02/02/06	02/14/06	KWG0601824	
<b>Di-n-octyl Phthalate</b>	<b>28</b>		11	2.6	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(b)fluoranthene</b>	<b>160</b>		11	5.4	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(k)fluoranthene</b>	<b>54</b>		11	5.4	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(a)pyrene</b>	<b>76</b>		11	3.5	1	02/02/06	02/14/06	KWG0601824	
<b>Indeno(1,2,3-cd)pyrene</b>	<b>48</b>		11	4.1	1	02/02/06	02/14/06	KWG0601824	
<b>Dibenz(a,h)anthracene</b>	<b>11</b>		11	4.8	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(g,h,i)perylene</b>	<b>44</b>		11	5.0	1	02/02/06	02/14/06	KWG0601824	

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-100  
**Lab Code:** K0600765-001

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	40	11-87	02/14/06	Acceptable
Phenol-d6	51	20-99	02/14/06	Acceptable
Nitrobenzene-d5	40	10-99	02/14/06	Acceptable
2-Fluorobiphenyl	27	10-104	02/14/06	Acceptable
2,4,6-Tribromophenol	69	23-113	02/15/06	Acceptable
Terphenyl-d14	39	39-124	02/14/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-101  
**Lab Code:** K0600765-002  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	13	5.9	1	02/02/06	02/14/06	KWG0601824	
<b>Phenol</b>	<b>11</b>	J	37	4.7	1	02/02/06	02/14/06	KWG0601824	
2-Chlorophenol	ND	U	13	4.2	1	02/02/06	02/14/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	13	4.0	1	02/02/06	02/14/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	13	4.7	1	02/02/06	02/14/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	13	3.2	1	02/02/06	02/14/06	KWG0601824	
Benzyl Alcohol	ND	U	13	9.1	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	13	3.0	1	02/02/06	02/14/06	KWG0601824	
2-Methylphenol	ND	U	13	8.4	1	02/02/06	02/14/06	KWG0601824	
Hexachloroethane	ND	U	13	5.4	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	13	7.9	1	02/02/06	02/14/06	KWG0601824	
<b>4-Methylphenol†</b>	<b>22</b>		13	7.1	1	02/02/06	02/14/06	KWG0601824	
Nitrobenzene	ND	U	13	4.9	1	02/02/06	02/14/06	KWG0601824	
Isophorone	ND	U	13	4.0	1	02/02/06	02/14/06	KWG0601824	
2-Nitrophenol	ND	U	13	6.4	1	02/02/06	02/14/06	KWG0601824	
2,4-Dimethylphenol	ND	U	61	14	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	13	3.2	1	02/02/06	02/14/06	KWG0601824	
2,4-Dichlorophenol	ND	U	13	4.5	1	02/02/06	02/14/06	KWG0601824	
Benzoic Acid	ND	U	250	240	1	02/02/06	02/14/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	13	3.7	1	02/02/06	02/14/06	KWG0601824	
<b>Naphthalene</b>	<b>40</b>		13	3.2	1	02/02/06	02/14/06	KWG0601824	
4-Chloroaniline	ND	U	13	5.2	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobutadiene	ND	U	13	3.5	1	02/02/06	02/14/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	13	5.2	1	02/02/06	02/14/06	KWG0601824	
<b>2-Methylnaphthalene</b>	<b>20</b>		13	3.0	1	02/02/06	02/14/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	6100	3700	100	02/02/06	02/15/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	1300	450	100	02/02/06	02/15/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	1300	740	100	02/02/06	02/15/06	KWG0601824	
2-Chloronaphthalene	ND	U	1300	890	100	02/02/06	02/15/06	KWG0601824	
2-Nitroaniline	ND	U	2500	670	100	02/02/06	02/15/06	KWG0601824	
Acenaphthylene	ND	U	1300	350	100	02/02/06	02/15/06	KWG0601824	
Dimethyl Phthalate	ND	U	1300	450	100	02/02/06	02/15/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	1300	690	100	02/02/06	02/15/06	KWG0601824	

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-101  
**Lab Code:** K0600765-002  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	ND	U	1300	250	100	02/02/06	02/15/06	KWG0601824	
3-Nitroaniline	ND	U	2500	640	100	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrophenol	ND	U	25000	8900	100	02/02/06	02/15/06	KWG0601824	
Dibenzofuran	ND	U	1300	320	100	02/02/06	02/15/06	KWG0601824	
4-Nitrophenol	ND	U	13000	7400	100	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	1300	690	100	02/02/06	02/15/06	KWG0601824	
Fluorene	ND	U	1300	420	100	02/02/06	02/15/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	1300	490	100	02/02/06	02/15/06	KWG0601824	
Diethyl Phthalate	ND	U	1300	860	100	02/02/06	02/15/06	KWG0601824	
4-Nitroaniline	ND	U	2500	840	100	02/02/06	02/15/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	13000	420	100	02/02/06	02/15/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	1300	540	100	02/02/06	02/15/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	1300	350	100	02/02/06	02/15/06	KWG0601824	
Hexachlorobenzene	ND	U	1300	520	100	02/02/06	02/15/06	KWG0601824	
Pentachlorophenol	ND	U	13000	2100	100	02/02/06	02/15/06	KWG0601824	
<b>Phenanthrene</b>	<b>540</b>	<b>JD</b>	1300	320	100	02/02/06	02/15/06	KWG0601824	
Anthracene	ND	U	1300	350	100	02/02/06	02/15/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	1300	640	100	02/02/06	02/15/06	KWG0601824	
<b>Fluoranthene</b>	<b>2000</b>	<b>D</b>	1300	540	100	02/02/06	02/15/06	KWG0601824	
<b>Pyrene</b>	<b>570</b>		13	3.2	1	02/02/06	02/14/06	KWG0601824	
Butyl Benzyl Phthalate	ND	Ui	13	5.0	1	02/02/06	02/14/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	130	9.1	1	02/02/06	02/14/06	KWG0601824	
<b>Benz(a)anthracene</b>	<b>240</b>		13	3.5	1	02/02/06	02/14/06	KWG0601824	
<b>Chrysene</b>	<b>710</b>		13	3.5	1	02/02/06	02/14/06	KWG0601824	
<b>Bis(2-ethylhexyl) Phthalate</b>	<b>120</b>	<b>J</b>	250	4.2	1	02/02/06	02/14/06	KWG0601824	
<b>Di-n-octyl Phthalate</b>	<b>100</b>		13	3.0	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(b)fluoranthene</b>	<b>380</b>		13	6.2	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(k)fluoranthene</b>	<b>120</b>		13	6.2	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(a)pyrene</b>	<b>160</b>		13	4.0	1	02/02/06	02/14/06	KWG0601824	
<b>Indeno(1,2,3-cd)pyrene</b>	<b>96</b>		13	4.7	1	02/02/06	02/14/06	KWG0601824	
<b>Dibenz(a,h)anthracene</b>	<b>19</b>		13	5.4	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(g,h,i)perylene</b>	<b>74</b>		13	5.7	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-101  
**Lab Code:** K0600765-002

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	49	11-87	02/14/06	Acceptable
Phenol-d6	61	20-99	02/14/06	Acceptable
Nitrobenzene-d5	50	10-99	02/14/06	Acceptable
2-Fluorobiphenyl	49	10-104	02/15/06	Acceptable
2,4,6-Tribromophenol	84	23-113	02/15/06	Acceptable
Terphenyl-d14	41	39-124	02/14/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

**Comments:** \_\_\_\_\_



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-102  
**Lab Code:** K0600765-003  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	19	8.9	1	02/02/06	02/14/06	KWG0601824	
<b>Phenol</b>	<b>19</b>	<b>J</b>	56	7.1	1	02/02/06	02/14/06	KWG0601824	
2-Chlorophenol	ND	U	19	6.3	1	02/02/06	02/14/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	19	6.0	1	02/02/06	02/14/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	19	7.1	1	02/02/06	02/14/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	19	4.8	1	02/02/06	02/14/06	KWG0601824	
Benzyl Alcohol	ND	U	19	14	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	19	4.5	1	02/02/06	02/14/06	KWG0601824	
2-Methylphenol	ND	U	19	13	1	02/02/06	02/14/06	KWG0601824	
Hexachloroethane	ND	U	19	8.2	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	19	12	1	02/02/06	02/14/06	KWG0601824	
<b>4-Methylphenol†</b>	<b>25</b>		19	11	1	02/02/06	02/14/06	KWG0601824	
Nitrobenzene	ND	U	19	7.4	1	02/02/06	02/14/06	KWG0601824	
Isophorone	ND	U	19	6.0	1	02/02/06	02/14/06	KWG0601824	
2-Nitrophenol	ND	U	19	9.6	1	02/02/06	02/14/06	KWG0601824	
2,4-Dimethylphenol	ND	U	93	21	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	19	4.8	1	02/02/06	02/14/06	KWG0601824	
2,4-Dichlorophenol	ND	U	19	6.7	1	02/02/06	02/14/06	KWG0601824	
Benzoic Acid	ND	U	370	360	1	02/02/06	02/14/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	19	5.6	1	02/02/06	02/14/06	KWG0601824	
<b>Naphthalene</b>	<b>160</b>		19	4.8	1	02/02/06	02/14/06	KWG0601824	
4-Chloroaniline	ND	U	19	7.8	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobutadiene	ND	U	19	5.2	1	02/02/06	02/14/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	19	7.8	1	02/02/06	02/14/06	KWG0601824	
<b>2-Methylnaphthalene</b>	<b>60</b>		19	4.5	1	02/02/06	02/14/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	9300	5600	100	02/02/06	02/15/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	1900	670	100	02/02/06	02/15/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	1900	1200	100	02/02/06	02/15/06	KWG0601824	
2-Chloronaphthalene	ND	U	1900	1400	100	02/02/06	02/15/06	KWG0601824	
2-Nitroaniline	ND	U	3700	1000	100	02/02/06	02/15/06	KWG0601824	
Acenaphthylene	ND	U	1900	520	100	02/02/06	02/15/06	KWG0601824	
Dimethyl Phthalate	ND	U	1900	670	100	02/02/06	02/15/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	1900	1100	100	02/02/06	02/15/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-102  
**Lab Code:** K0600765-003  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	ND	U	1900	370	100	02/02/06	02/15/06	KWG0601824	
3-Nitroaniline	ND	U	3700	960	100	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrophenol	ND	U	37000	14000	100	02/02/06	02/15/06	KWG0601824	
Dibenzofuran	ND	U	1900	480	100	02/02/06	02/15/06	KWG0601824	
4-Nitrophenol	ND	U	19000	12000	100	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	1900	1100	100	02/02/06	02/15/06	KWG0601824	
Fluorene	ND	U	1900	630	100	02/02/06	02/15/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	1900	740	100	02/02/06	02/15/06	KWG0601824	
Diethyl Phthalate	ND	U	1900	1300	100	02/02/06	02/15/06	KWG0601824	
4-Nitroaniline	ND	U	3700	1300	100	02/02/06	02/15/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	19000	630	100	02/02/06	02/15/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	1900	820	100	02/02/06	02/15/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	1900	520	100	02/02/06	02/15/06	KWG0601824	
Hexachlorobenzene	ND	U	1900	780	100	02/02/06	02/15/06	KWG0601824	
Pentachlorophenol	ND	U	19000	3200	100	02/02/06	02/15/06	KWG0601824	
<b>Phenanthrene</b>	<b>620</b>	<b>JD</b>	1900	480	100	02/02/06	02/15/06	KWG0601824	
<b>Anthracene</b>	<b>700</b>	<b>JD</b>	1900	520	100	02/02/06	02/15/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	1900	960	100	02/02/06	02/15/06	KWG0601824	
<b>Fluoranthene</b>	<b>4100</b>	<b>D</b>	1900	820	100	02/02/06	02/15/06	KWG0601824	
<b>Pyrene</b>	<b>1100</b>		19	4.8	1	02/02/06	02/14/06	KWG0601824	
Butyl Benzyl Phthalate	ND	U	19	5.6	1	02/02/06	02/14/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	190	14	1	02/02/06	02/14/06	KWG0601824	
<b>Benz(a)anthracene</b>	<b>920</b>		19	5.2	1	02/02/06	02/14/06	KWG0601824	
<b>Chrysene</b>	<b>2500</b>	<b>D</b>	1900	520	100	02/02/06	02/15/06	KWG0601824	
<b>Bis(2-ethylhexyl) Phthalate</b>	<b>160</b>	<b>J</b>	370	6.3	1	02/02/06	02/14/06	KWG0601824	
Di-n-octyl Phthalate	ND	U	19	4.5	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(b)fluoranthene</b>	<b>1400</b>	<b>JD</b>	1900	930	100	02/02/06	02/15/06	KWG0601824	
<b>Benzo(k)fluoranthene</b>	<b>300</b>		19	9.3	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(a)pyrene</b>	<b>450</b>		19	6.0	1	02/02/06	02/14/06	KWG0601824	
<b>Indeno(1,2,3-cd)pyrene</b>	<b>280</b>		19	7.1	1	02/02/06	02/14/06	KWG0601824	
<b>Dibenz(a,h)anthracene</b>	<b>56</b>		19	8.2	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(g,h,i)perylene</b>	<b>210</b>		19	8.5	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-102  
**Lab Code:** K0600765-003

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	41	11-87	02/14/06	Acceptable
Phenol-d6	58	20-99	02/14/06	Acceptable
Nitrobenzene-d5	41	10-99	02/14/06	Acceptable
2-Fluorobiphenyl	73	10-104	02/15/06	Acceptable
2,4,6-Tribromophenol	76	23-113	02/15/06	Acceptable
Terphenyl-d14	41	39-124	02/14/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-103  
**Lab Code:** K0600765-004  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	12	5.5	1	02/02/06	02/14/06	KWG0601824	
<b>Phenol</b>	<b>7.0</b>	<b>J</b>	35	4.4	1	02/02/06	02/14/06	KWG0601824	
2-Chlorophenol	ND	U	12	3.9	1	02/02/06	02/14/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	12	3.7	1	02/02/06	02/14/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	12	4.4	1	02/02/06	02/14/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	12	3.0	1	02/02/06	02/14/06	KWG0601824	
Benzyl Alcohol	ND	U	12	8.5	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	12	2.8	1	02/02/06	02/14/06	KWG0601824	
2-Methylphenol	ND	U	12	7.8	1	02/02/06	02/14/06	KWG0601824	
Hexachloroethane	ND	U	12	5.1	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	12	7.4	1	02/02/06	02/14/06	KWG0601824	
<b>4-Methylphenol†</b>	<b>8.7</b>	<b>J</b>	12	6.7	1	02/02/06	02/14/06	KWG0601824	
Nitrobenzene	ND	U	12	4.6	1	02/02/06	02/14/06	KWG0601824	
Isophorone	ND	U	12	3.7	1	02/02/06	02/14/06	KWG0601824	
2-Nitrophenol	ND	U	12	6.0	1	02/02/06	02/14/06	KWG0601824	
2,4-Dimethylphenol	ND	U	58	13	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	12	3.0	1	02/02/06	02/14/06	KWG0601824	
2,4-Dichlorophenol	ND	U	12	4.2	1	02/02/06	02/14/06	KWG0601824	
Benzoic Acid	ND	U	230	220	1	02/02/06	02/14/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	12	3.5	1	02/02/06	02/14/06	KWG0601824	
<b>Naphthalene</b>	<b>6.9</b>	<b>J</b>	12	3.0	1	02/02/06	02/14/06	KWG0601824	
4-Chloroaniline	ND	U	12	4.9	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobutadiene	ND	U	12	3.3	1	02/02/06	02/14/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	12	4.9	1	02/02/06	02/14/06	KWG0601824	
<b>2-Methylnaphthalene</b>	<b>8.3</b>	<b>J</b>	12	2.8	1	02/02/06	02/14/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	58	35	1	02/02/06	02/14/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	12	4.2	1	02/02/06	02/14/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	12	6.9	1	02/02/06	02/14/06	KWG0601824	
2-Chloronaphthalene	ND	U	12	8.3	1	02/02/06	02/14/06	KWG0601824	
2-Nitroaniline	ND	U	23	6.2	1	02/02/06	02/14/06	KWG0601824	
<b>Acenaphthylene</b>	<b>15</b>		12	3.3	1	02/02/06	02/14/06	KWG0601824	
Dimethyl Phthalate	ND	U	12	4.2	1	02/02/06	02/14/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	12	6.5	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-103  
**Lab Code:** K0600765-004  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	10	J	12	2.3	1	02/02/06	02/14/06	KWG0601824	
3-Nitroaniline	ND	U	23	6.0	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrophenol	ND	U	230	83	1	02/02/06	02/14/06	KWG0601824	
Dibenzofuran	16		12	3.0	1	02/02/06	02/14/06	KWG0601824	
4-Nitrophenol	ND	U	120	69	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	12	6.5	1	02/02/06	02/14/06	KWG0601824	
Fluorene	45		12	3.9	1	02/02/06	02/14/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	12	4.6	1	02/02/06	02/14/06	KWG0601824	
Diethyl Phthalate	ND	U	12	8.1	1	02/02/06	02/14/06	KWG0601824	
4-Nitroaniline	ND	U	23	7.8	1	02/02/06	02/14/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	120	3.9	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	12	5.1	1	02/02/06	02/14/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	12	3.3	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobenzene	ND	U	12	4.9	1	02/02/06	02/14/06	KWG0601824	
Pentachlorophenol	ND	U	120	20	1	02/02/06	02/14/06	KWG0601824	
Phenanthrene	110		12	3.0	1	02/02/06	02/14/06	KWG0601824	
Anthracene	480		12	3.3	1	02/02/06	02/14/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	12	6.0	1	02/02/06	02/14/06	KWG0601824	
Fluoranthene	250		12	5.1	1	02/02/06	02/14/06	KWG0601824	
Pyrene	280		12	3.0	1	02/02/06	02/14/06	KWG0601824	
Butyl Benzyl Phthalate	ND	U	12	3.5	1	02/02/06	02/14/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	120	8.5	1	02/02/06	02/14/06	KWG0601824	
Benz(a)anthracene	170		12	3.3	1	02/02/06	02/14/06	KWG0601824	
Chrysene	320		12	3.3	1	02/02/06	02/14/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	18	J	230	3.9	1	02/02/06	02/14/06	KWG0601824	
Di-n-octyl Phthalate	ND	U	12	2.8	1	02/02/06	02/14/06	KWG0601824	
Benzo(b)fluoranthene	170		12	5.8	1	02/02/06	02/14/06	KWG0601824	
Benzo(k)fluoranthene	58		12	5.8	1	02/02/06	02/14/06	KWG0601824	
Benzo(a)pyrene	58		12	3.7	1	02/02/06	02/14/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	39		12	4.4	1	02/02/06	02/14/06	KWG0601824	
Dibenz(a,h)anthracene	8.4	J	12	5.1	1	02/02/06	02/14/06	KWG0601824	
Benzo(g,h,i)perylene	32		12	5.3	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-103  
**Lab Code:** K0600765-004

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	49	11-87	02/14/06	Acceptable
Phenol-d6	61	20-99	02/14/06	Acceptable
Nitrobenzene-d5	57	10-99	02/14/06	Acceptable
2-Fluorobiphenyl	22	10-104	02/14/06	Acceptable
2,4,6-Tribromophenol	58	23-113	02/14/06	Acceptable
Terphenyl-d14	55	39-124	02/14/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-104  
**Lab Code:** K0600765-005  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	12	5.4	1	02/02/06	02/15/06	KWG0601824	
Phenol	8.6	J	34	4.3	1	02/02/06	02/15/06	KWG0601824	
2-Chlorophenol	ND	U	12	3.8	1	02/02/06	02/15/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	12	3.6	1	02/02/06	02/15/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	12	4.3	1	02/02/06	02/15/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	12	2.9	1	02/02/06	02/15/06	KWG0601824	
Benzyl Alcohol	ND	U	12	8.3	1	02/02/06	02/15/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	12	2.7	1	02/02/06	02/15/06	KWG0601824	
2-Methylphenol	ND	U	12	7.6	1	02/02/06	02/15/06	KWG0601824	
Hexachloroethane	ND	U	12	4.9	1	02/02/06	02/15/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	12	7.1	1	02/02/06	02/15/06	KWG0601824	
4-Methylphenol†	ND	U	12	6.5	1	02/02/06	02/15/06	KWG0601824	
Nitrobenzene	ND	U	12	4.5	1	02/02/06	02/15/06	KWG0601824	
Isophorone	ND	U	12	3.6	1	02/02/06	02/15/06	KWG0601824	
2-Nitrophenol	ND	U	12	5.8	1	02/02/06	02/15/06	KWG0601824	
2,4-Dimethylphenol	ND	U	56	13	1	02/02/06	02/15/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	12	2.9	1	02/02/06	02/15/06	KWG0601824	
2,4-Dichlorophenol	ND	U	12	4.0	1	02/02/06	02/15/06	KWG0601824	
Benzoic Acid	ND	U	230	220	1	02/02/06	02/15/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	12	3.4	1	02/02/06	02/15/06	KWG0601824	
Naphthalene	ND	U	12	2.9	1	02/02/06	02/15/06	KWG0601824	
4-Chloroaniline	ND	U	12	4.7	1	02/02/06	02/15/06	KWG0601824	
Hexachlorobutadiene	ND	U	12	3.2	1	02/02/06	02/15/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	12	4.7	1	02/02/06	02/15/06	KWG0601824	
2-Methylnaphthalene	ND	U	12	2.7	1	02/02/06	02/15/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	56	34	1	02/02/06	02/15/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	12	4.0	1	02/02/06	02/15/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	12	6.7	1	02/02/06	02/15/06	KWG0601824	
2-Chloronaphthalene	ND	U	12	8.0	1	02/02/06	02/15/06	KWG0601824	
2-Nitroaniline	ND	U	23	6.0	1	02/02/06	02/15/06	KWG0601824	
Acenaphthylene	ND	U	12	3.2	1	02/02/06	02/15/06	KWG0601824	
Dimethyl Phthalate	ND	U	12	4.0	1	02/02/06	02/15/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	12	6.3	1	02/02/06	02/15/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-104  
**Lab Code:** K0600765-005  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	ND	U	12	2.3	1	02/02/06	02/15/06	KWG0601824	
3-Nitroaniline	ND	U	23	5.8	1	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrophenol	ND	U	230	80	1	02/02/06	02/15/06	KWG0601824	
Dibenzofuran	ND	U	12	2.9	1	02/02/06	02/15/06	KWG0601824	
4-Nitrophenol	ND	U	120	67	1	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	12	6.3	1	02/02/06	02/15/06	KWG0601824	
Fluorene	ND	U	12	3.8	1	02/02/06	02/15/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	12	4.5	1	02/02/06	02/15/06	KWG0601824	
Diethyl Phthalate	ND	U	12	7.8	1	02/02/06	02/15/06	KWG0601824	
4-Nitroaniline	ND	U	23	7.6	1	02/02/06	02/15/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	120	3.8	1	02/02/06	02/15/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	12	4.9	1	02/02/06	02/15/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	12	3.2	1	02/02/06	02/15/06	KWG0601824	
Hexachlorobenzene	ND	U	12	4.7	1	02/02/06	02/15/06	KWG0601824	
Pentachlorophenol	ND	U	120	19	1	02/02/06	02/15/06	KWG0601824	
<b>Phenanthrene</b>	<b>8.6</b>	<b>J</b>	12	2.9	1	02/02/06	02/15/06	KWG0601824	
Anthracene	ND	U	12	3.2	1	02/02/06	02/15/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	12	5.8	1	02/02/06	02/15/06	KWG0601824	
<b>Fluoranthene</b>	<b>20</b>		12	4.9	1	02/02/06	02/15/06	KWG0601824	
<b>Pyrene</b>	<b>22</b>		12	2.9	1	02/02/06	02/15/06	KWG0601824	
Butyl Benzyl Phthalate	ND	U	12	3.4	1	02/02/06	02/15/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	120	8.3	1	02/02/06	02/15/06	KWG0601824	
<b>Benz(a)anthracene</b>	<b>10</b>	<b>J</b>	12	3.2	1	02/02/06	02/15/06	KWG0601824	
<b>Chrysene</b>	<b>18</b>		12	3.2	1	02/02/06	02/15/06	KWG0601824	
<b>Bis(2-ethylhexyl) Phthalate</b>	<b>7.6</b>	<b>J</b>	230	3.8	1	02/02/06	02/15/06	KWG0601824	
Di-n-octyl Phthalate	ND	U	12	2.7	1	02/02/06	02/15/06	KWG0601824	
<b>Benzo(b)fluoranthene</b>	<b>15</b>		12	5.6	1	02/02/06	02/15/06	KWG0601824	
<b>Benzo(k)fluoranthene</b>	<b>5.8</b>	<b>J</b>	12	5.6	1	02/02/06	02/15/06	KWG0601824	
<b>Benzo(a)pyrene</b>	<b>11</b>	<b>J</b>	12	3.6	1	02/02/06	02/15/06	KWG0601824	
<b>Indeno(1,2,3-cd)pyrene</b>	<b>8.8</b>	<b>J</b>	12	4.3	1	02/02/06	02/15/06	KWG0601824	
Dibenz(a,h)anthracene	ND	U	12	4.9	1	02/02/06	02/15/06	KWG0601824	
<b>Benzo(g,h,i)perylene</b>	<b>9.3</b>	<b>J</b>	12	5.1	1	02/02/06	02/15/06	KWG0601824	

**Comments:** \_\_\_\_\_



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** SD-104  
**Lab Code:** K0600765-005

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	46	11-87	02/15/06	Acceptable
Phenol-d6	57	20-99	02/15/06	Acceptable
Nitrobenzene-d5	55	10-99	02/15/06	Acceptable
2-Fluorobiphenyl	20	10-104	02/15/06	Acceptable
2,4,6-Tribromophenol	61	23-113	02/15/06	Acceptable
Terphenyl-d14	59	39-124	02/15/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** REF-EBB  
**Lab Code:** K0600765-006  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	11	4.9	1	02/02/06	02/15/06	KWG0601824	
<b>Phenol</b>	<b>8.0</b>	<b>J</b>	31	3.9	1	02/02/06	02/15/06	KWG0601824	
2-Chlorophenol	ND	U	11	3.5	1	02/02/06	02/15/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	11	3.3	1	02/02/06	02/15/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	11	3.9	1	02/02/06	02/15/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	11	2.7	1	02/02/06	02/15/06	KWG0601824	
Benzyl Alcohol	ND	U	11	7.6	1	02/02/06	02/15/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	11	2.5	1	02/02/06	02/15/06	KWG0601824	
2-Methylphenol	ND	U	11	7.0	1	02/02/06	02/15/06	KWG0601824	
Hexachloroethane	ND	U	11	4.5	1	02/02/06	02/15/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	11	6.6	1	02/02/06	02/15/06	KWG0601824	
4-Methylphenol†	ND	U	11	6.0	1	02/02/06	02/15/06	KWG0601824	
Nitrobenzene	ND	U	11	4.1	1	02/02/06	02/15/06	KWG0601824	
Isophorone	ND	U	11	3.3	1	02/02/06	02/15/06	KWG0601824	
2-Nitrophenol	ND	U	11	5.4	1	02/02/06	02/15/06	KWG0601824	
2,4-Dimethylphenol	ND	U	52	12	1	02/02/06	02/15/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	11	2.7	1	02/02/06	02/15/06	KWG0601824	
2,4-Dichlorophenol	ND	U	11	3.7	1	02/02/06	02/15/06	KWG0601824	
Benzoic Acid	ND	U	210	200	1	02/02/06	02/15/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	11	3.1	1	02/02/06	02/15/06	KWG0601824	
Naphthalene	ND	U	11	2.7	1	02/02/06	02/15/06	KWG0601824	
4-Chloroaniline	ND	U	11	4.3	1	02/02/06	02/15/06	KWG0601824	
Hexachlorobutadiene	ND	U	11	2.9	1	02/02/06	02/15/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	11	4.3	1	02/02/06	02/15/06	KWG0601824	
2-Methylnaphthalene	ND	U	11	2.5	1	02/02/06	02/15/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	52	31	1	02/02/06	02/15/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	11	3.7	1	02/02/06	02/15/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	11	6.2	1	02/02/06	02/15/06	KWG0601824	
2-Chloronaphthalene	ND	U	11	7.4	1	02/02/06	02/15/06	KWG0601824	
2-Nitroaniline	ND	U	21	5.6	1	02/02/06	02/15/06	KWG0601824	
Acenaphthylene	ND	U	11	2.9	1	02/02/06	02/15/06	KWG0601824	
Dimethyl Phthalate	ND	U	11	3.7	1	02/02/06	02/15/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	11	5.8	1	02/02/06	02/15/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** REF-EBB  
**Lab Code:** K0600765-006  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	ND	U	11	2.1	1	02/02/06	02/15/06	KWG0601824	
3-Nitroaniline	ND	U	21	5.4	1	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrophenol	ND	U	210	74	1	02/02/06	02/15/06	KWG0601824	
Dibenzofuran	ND	U	11	2.7	1	02/02/06	02/15/06	KWG0601824	
4-Nitrophenol	ND	U	110	62	1	02/02/06	02/15/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	11	5.8	1	02/02/06	02/15/06	KWG0601824	
Fluorene	ND	U	11	3.5	1	02/02/06	02/15/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	11	4.1	1	02/02/06	02/15/06	KWG0601824	
Diethyl Phthalate	ND	U	11	7.2	1	02/02/06	02/15/06	KWG0601824	
4-Nitroaniline	ND	U	21	7.0	1	02/02/06	02/15/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	110	3.5	1	02/02/06	02/15/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	11	4.5	1	02/02/06	02/15/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	11	2.9	1	02/02/06	02/15/06	KWG0601824	
Hexachlorobenzene	ND	U	11	4.3	1	02/02/06	02/15/06	KWG0601824	
Pentachlorophenol	ND	U	110	18	1	02/02/06	02/15/06	KWG0601824	
<b>Phenanthrene</b>	<b>4.1</b>	<b>J</b>	11	2.7	1	02/02/06	02/15/06	KWG0601824	
Anthracene	ND	U	11	2.9	1	02/02/06	02/15/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	11	5.4	1	02/02/06	02/15/06	KWG0601824	
<b>Fluoranthene</b>	<b>12</b>		11	4.5	1	02/02/06	02/15/06	KWG0601824	
<b>Pyrene</b>	<b>15</b>		11	2.7	1	02/02/06	02/15/06	KWG0601824	
Butyl Benzyl Phthalate	ND	U	11	3.1	1	02/02/06	02/15/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	110	7.6	1	02/02/06	02/15/06	KWG0601824	
<b>Benz(a)anthracene</b>	<b>6.6</b>	<b>J</b>	11	2.9	1	02/02/06	02/15/06	KWG0601824	
<b>Chrysene</b>	<b>9.3</b>	<b>J</b>	11	2.9	1	02/02/06	02/15/06	KWG0601824	
<b>Bis(2-ethylhexyl) Phthalate</b>	<b>6.1</b>	<b>J</b>	210	3.5	1	02/02/06	02/15/06	KWG0601824	
Di-n-octyl Phthalate	ND	U	11	2.5	1	02/02/06	02/15/06	KWG0601824	
<b>Benzo(b)fluoranthene</b>	<b>11</b>	<b>J</b>	11	5.2	1	02/02/06	02/15/06	KWG0601824	
Benzo(k)fluoranthene	ND	U	11	5.2	1	02/02/06	02/15/06	KWG0601824	
<b>Benzo(a)pyrene</b>	<b>9.3</b>	<b>J</b>	11	3.3	1	02/02/06	02/15/06	KWG0601824	
<b>Indeno(1,2,3-cd)pyrene</b>	<b>7.3</b>	<b>J</b>	11	3.9	1	02/02/06	02/15/06	KWG0601824	
Dibenz(a,h)anthracene	ND	U	11	4.5	1	02/02/06	02/15/06	KWG0601824	
<b>Benzo(g,h,i)perylene</b>	<b>7.8</b>	<b>J</b>	11	4.7	1	02/02/06	02/15/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** REF-EBB  
**Lab Code:** K0600765-006

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	41	11-87	02/15/06	Acceptable
Phenol-d6	57	20-99	02/15/06	Acceptable
Nitrobenzene-d5	39	10-99	02/15/06	Acceptable
2-Fluorobiphenyl	19	10-104	02/15/06	Acceptable
2,4,6-Tribromophenol	65	23-113	02/15/06	Acceptable
Terphenyl-d14	60	39-124	02/15/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	10	4.3	1	02/02/06	02/14/06	KWG0601824	
Phenol	5.5	J	30	3.4	1	02/02/06	02/14/06	KWG0601824	
2-Chlorophenol	ND	U	10	3.1	1	02/02/06	02/14/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	10	2.9	1	02/02/06	02/14/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	10	3.4	1	02/02/06	02/14/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	10	2.4	1	02/02/06	02/14/06	KWG0601824	
Benzyl Alcohol	ND	U	10	6.6	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	10	2.2	1	02/02/06	02/14/06	KWG0601824	
2-Methylphenol	ND	U	10	6.1	1	02/02/06	02/14/06	KWG0601824	
Hexachloroethane	ND	U	10	3.9	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	10	5.7	1	02/02/06	02/14/06	KWG0601824	
4-Methylphenol†	ND	U	10	5.2	1	02/02/06	02/14/06	KWG0601824	
Nitrobenzene	ND	U	10	3.6	1	02/02/06	02/14/06	KWG0601824	
Isophorone	ND	U	10	2.9	1	02/02/06	02/14/06	KWG0601824	
2-Nitrophenol	ND	U	10	4.7	1	02/02/06	02/14/06	KWG0601824	
2,4-Dimethylphenol	ND	U	50	9.8	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	10	2.4	1	02/02/06	02/14/06	KWG0601824	
2,4-Dichlorophenol	ND	U	10	3.2	1	02/02/06	02/14/06	KWG0601824	
Benzoic Acid	ND	U	200	170	1	02/02/06	02/14/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	10	2.7	1	02/02/06	02/14/06	KWG0601824	
Naphthalene	ND	U	10	2.4	1	02/02/06	02/14/06	KWG0601824	
4-Chloroaniline	ND	U	10	3.8	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobutadiene	ND	U	10	2.5	1	02/02/06	02/14/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	10	3.8	1	02/02/06	02/14/06	KWG0601824	
2-Methylnaphthalene	ND	U	10	2.2	1	02/02/06	02/14/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	50	27	1	02/02/06	02/14/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	10	3.2	1	02/02/06	02/14/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	10	5.4	1	02/02/06	02/14/06	KWG0601824	
2-Chloronaphthalene	ND	U	10	6.4	1	02/02/06	02/14/06	KWG0601824	
2-Nitroaniline	ND	U	20	4.8	1	02/02/06	02/14/06	KWG0601824	
Acenaphthylene	ND	U	10	2.5	1	02/02/06	02/14/06	KWG0601824	
Dimethyl Phthalate	ND	U	10	3.2	1	02/02/06	02/14/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	10	5.0	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	ND	U	10	1.8	1	02/02/06	02/14/06	KWG0601824	
3-Nitroaniline	ND	U	20	4.7	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrophenol	ND	U	200	64	1	02/02/06	02/14/06	KWG0601824	
Dibenzofuran	ND	U	10	2.4	1	02/02/06	02/14/06	KWG0601824	
4-Nitrophenol	ND	U	100	54	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	10	5.0	1	02/02/06	02/14/06	KWG0601824	
Fluorene	ND	U	10	3.1	1	02/02/06	02/14/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	10	3.6	1	02/02/06	02/14/06	KWG0601824	
Diethyl Phthalate	ND	U	10	6.2	1	02/02/06	02/14/06	KWG0601824	
4-Nitroaniline	ND	U	20	6.1	1	02/02/06	02/14/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	100	3.1	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	10	3.9	1	02/02/06	02/14/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	10	2.5	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobenzene	ND	U	10	3.8	1	02/02/06	02/14/06	KWG0601824	
Pentachlorophenol	ND	U	100	16	1	02/02/06	02/14/06	KWG0601824	
<b>Phenanthrene</b>	<b>3.7</b>	<b>J</b>	10	2.4	1	02/02/06	02/14/06	KWG0601824	
Anthracene	ND	U	10	2.5	1	02/02/06	02/14/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	10	4.7	1	02/02/06	02/14/06	KWG0601824	
<b>Fluoranthene</b>	<b>11</b>		10	3.9	1	02/02/06	02/14/06	KWG0601824	
<b>Pyrene</b>	<b>13</b>		10	2.4	1	02/02/06	02/14/06	KWG0601824	
Butyl Benzyl Phthalate	ND	U	10	2.7	1	02/02/06	02/14/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	100	6.6	1	02/02/06	02/14/06	KWG0601824	
<b>Benz(a)anthracene</b>	<b>5.8</b>	<b>J</b>	10	2.5	1	02/02/06	02/14/06	KWG0601824	
<b>Chrysene</b>	<b>8.6</b>	<b>J</b>	10	2.5	1	02/02/06	02/14/06	KWG0601824	
<b>Bis(2-ethylhexyl) Phthalate</b>	<b>3.7</b>	<b>J</b>	200	3.1	1	02/02/06	02/14/06	KWG0601824	
Di-n-octyl Phthalate	ND	U	10	2.2	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(b)fluoranthene</b>	<b>10</b>		10	4.5	1	02/02/06	02/14/06	KWG0601824	
Benzo(k)fluoranthene	ND	U	10	4.5	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(a)pyrene</b>	<b>9.3</b>	<b>J</b>	10	2.9	1	02/02/06	02/14/06	KWG0601824	
<b>Indeno(1,2,3-cd)pyrene</b>	<b>7.7</b>	<b>J</b>	10	3.4	1	02/02/06	02/14/06	KWG0601824	
Dibenz(a,h)anthracene	ND	U	10	3.9	1	02/02/06	02/14/06	KWG0601824	
<b>Benzo(g,h,i)perylene</b>	<b>9.3</b>	<b>J</b>	10	4.1	1	02/02/06	02/14/06	KWG0601824	

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	29	11-87	02/14/06	Acceptable
Phenol-d6	38	20-99	02/14/06	Acceptable
Nitrobenzene-d5	34	10-99	02/14/06	Acceptable
2-Fluorobiphenyl	27	10-104	02/14/06	Acceptable
2,4,6-Tribromophenol	44	23-113	02/14/06	Acceptable
Terphenyl-d14	50	39-124	02/14/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** Method Blank  
**Lab Code:** KWG0601824-5  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Bis(2-chloroethyl) Ether	ND	U	5.0	2.4	1	02/02/06	02/14/06	KWG0601824	
Phenol	ND	U	15	1.9	1	02/02/06	02/14/06	KWG0601824	
2-Chlorophenol	ND	U	5.0	1.7	1	02/02/06	02/14/06	KWG0601824	
1,3-Dichlorobenzene	ND	U	5.0	1.6	1	02/02/06	02/14/06	KWG0601824	
1,4-Dichlorobenzene	ND	U	5.0	1.9	1	02/02/06	02/14/06	KWG0601824	
1,2-Dichlorobenzene	ND	U	5.0	1.3	1	02/02/06	02/14/06	KWG0601824	
Benzyl Alcohol	ND	U	5.0	3.7	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroisopropyl) Ether	ND	U	5.0	1.2	1	02/02/06	02/14/06	KWG0601824	
2-Methylphenol	ND	U	5.0	3.4	1	02/02/06	02/14/06	KWG0601824	
Hexachloroethane	ND	U	5.0	2.2	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodi-n-propylamine	ND	U	5.0	3.2	1	02/02/06	02/14/06	KWG0601824	
4-Methylphenol†	ND	U	5.0	2.9	1	02/02/06	02/14/06	KWG0601824	
Nitrobenzene	ND	U	5.0	2.0	1	02/02/06	02/14/06	KWG0601824	
Isophorone	ND	U	5.0	1.6	1	02/02/06	02/14/06	KWG0601824	
2-Nitrophenol	ND	U	5.0	2.6	1	02/02/06	02/14/06	KWG0601824	
2,4-Dimethylphenol	ND	U	25	5.5	1	02/02/06	02/14/06	KWG0601824	
Bis(2-chloroethoxy)methane	ND	U	5.0	1.3	1	02/02/06	02/14/06	KWG0601824	
2,4-Dichlorophenol	ND	U	5.0	1.8	1	02/02/06	02/14/06	KWG0601824	
Benzoic Acid	ND	U	100	96	1	02/02/06	02/14/06	KWG0601824	
1,2,4-Trichlorobenzene	ND	U	5.0	1.5	1	02/02/06	02/14/06	KWG0601824	
Naphthalene	ND	U	5.0	1.3	1	02/02/06	02/14/06	KWG0601824	
4-Chloroaniline	ND	U	5.0	2.1	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobutadiene	ND	U	5.0	1.4	1	02/02/06	02/14/06	KWG0601824	
4-Chloro-3-methylphenol	ND	U	5.0	2.1	1	02/02/06	02/14/06	KWG0601824	
2-Methylnaphthalene	ND	U	5.0	1.2	1	02/02/06	02/14/06	KWG0601824	
Hexachlorocyclopentadiene	ND	U	25	15	1	02/02/06	02/14/06	KWG0601824	
2,4,6-Trichlorophenol	ND	U	5.0	1.8	1	02/02/06	02/14/06	KWG0601824	
2,4,5-Trichlorophenol	ND	U	5.0	3.0	1	02/02/06	02/14/06	KWG0601824	
2-Chloronaphthalene	ND	U	5.0	3.6	1	02/02/06	02/14/06	KWG0601824	
2-Nitroaniline	ND	U	10	2.7	1	02/02/06	02/14/06	KWG0601824	
Acenaphthylene	ND	U	5.0	1.4	1	02/02/06	02/14/06	KWG0601824	
Dimethyl Phthalate	ND	U	5.0	1.8	1	02/02/06	02/14/06	KWG0601824	
2,6-Dinitrotoluene	ND	U	5.0	2.8	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** Method Blank  
**Lab Code:** KWG0601824-5  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Acenaphthene	ND	U	5.0	1.0	1	02/02/06	02/14/06	KWG0601824	
3-Nitroaniline	ND	U	10	2.6	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrophenol	ND	U	100	36	1	02/02/06	02/14/06	KWG0601824	
Dibenzofuran	ND	U	5.0	1.3	1	02/02/06	02/14/06	KWG0601824	
4-Nitrophenol	ND	U	50	30	1	02/02/06	02/14/06	KWG0601824	
2,4-Dinitrotoluene	ND	U	5.0	2.8	1	02/02/06	02/14/06	KWG0601824	
Fluorene	ND	U	5.0	1.7	1	02/02/06	02/14/06	KWG0601824	
4-Chlorophenyl Phenyl Ether	ND	U	5.0	2.0	1	02/02/06	02/14/06	KWG0601824	
Diethyl Phthalate	ND	U	5.0	3.5	1	02/02/06	02/14/06	KWG0601824	
4-Nitroaniline	ND	U	10	3.4	1	02/02/06	02/14/06	KWG0601824	
2-Methyl-4,6-dinitrophenol	ND	U	50	1.7	1	02/02/06	02/14/06	KWG0601824	
N-Nitrosodiphenylamine	ND	U	5.0	2.2	1	02/02/06	02/14/06	KWG0601824	
4-Bromophenyl Phenyl Ether	ND	U	5.0	1.4	1	02/02/06	02/14/06	KWG0601824	
Hexachlorobenzene	ND	U	5.0	2.1	1	02/02/06	02/14/06	KWG0601824	
Pentachlorophenol	ND	U	50	8.5	1	02/02/06	02/14/06	KWG0601824	
Phenanthrene	ND	U	5.0	1.3	1	02/02/06	02/14/06	KWG0601824	
Anthracene	ND	U	5.0	1.4	1	02/02/06	02/14/06	KWG0601824	
Di-n-butyl Phthalate	ND	U	5.0	2.6	1	02/02/06	02/14/06	KWG0601824	
Fluoranthene	ND	U	5.0	2.2	1	02/02/06	02/14/06	KWG0601824	
Pyrene	ND	U	5.0	1.3	1	02/02/06	02/14/06	KWG0601824	
Butyl Benzyl Phthalate	ND	U	5.0	1.5	1	02/02/06	02/14/06	KWG0601824	
3,3'-Dichlorobenzidine	ND	U	50	3.7	1	02/02/06	02/14/06	KWG0601824	
Benz(a)anthracene	ND	U	5.0	1.4	1	02/02/06	02/14/06	KWG0601824	
Chrysene	ND	U	5.0	1.4	1	02/02/06	02/14/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	3.9	J	100	1.7	1	02/02/06	02/14/06	KWG0601824	
Di-n-octyl Phthalate	ND	U	5.0	1.2	1	02/02/06	02/14/06	KWG0601824	
Benzo(b)fluoranthene	ND	U	5.0	2.5	1	02/02/06	02/14/06	KWG0601824	
Benzo(k)fluoranthene	ND	U	5.0	2.5	1	02/02/06	02/14/06	KWG0601824	
Benzo(a)pyrene	ND	U	5.0	1.6	1	02/02/06	02/14/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	ND	U	5.0	1.9	1	02/02/06	02/14/06	KWG0601824	
Dibenz(a,h)anthracene	ND	U	5.0	2.2	1	02/02/06	02/14/06	KWG0601824	
Benzo(g,h,i)perylene	ND	U	5.0	2.3	1	02/02/06	02/14/06	KWG0601824	

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Semi-Volatile Organic Compounds by GC/MS

**Sample Name:** Method Blank  
**Lab Code:** KWG0601824-5

**Units:** ug/Kg  
**Basis:** Dry

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
2-Fluorophenol	30	11-87	02/14/06	Acceptable
Phenol-d6	41	20-99	02/14/06	Acceptable
Nitrobenzene-d5	34	10-99	02/14/06	Acceptable
2-Fluorobiphenyl	36	10-104	02/14/06	Acceptable
2,4,6-Tribromophenol	49	23-113	02/14/06	Acceptable
Terphenyl-d14	66	39-124	02/14/06	Acceptable

## † Analyte Comments

4-Methylphenol This analyte cannot be separated from 3-Methylphenol.

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

Client: Kennedy/Jenks Consultants, Incorporated  
 Project: Astoria Area-Wide/0592004.00  
 Sample Matrix: Soil

Service Request: K0600765

**Surrogate Recovery Summary**  
**Semi-Volatile Organic Compounds by GC/MS**

Extraction Method: EPA 3541  
 Analysis Method: 8270C

Units: PERCENT  
 Level: Low

<u>Sample Name</u>	<u>Lab Code</u>	<u>Sur1</u>	<u>Sur2</u>	<u>Sur3</u>	<u>Sur4</u>	<u>Sur5</u>	<u>Sur6</u>
SD-100	K0600765-001	40	51	40	27	69 D #	39
SD-101	K0600765-002	49	61	50	49 D #	84 D #	41
SD-102	K0600765-003	41	58	41	73 D #	76 D #	41
SD-103	K0600765-004	49	61	57	22	58	55
SD-104	K0600765-005	46	57	55	20	61	59
REF-EBB	K0600765-006	41	57	39	19	65	60
REF-YB	K0600765-007	29	38	34	27	44	50
Method Blank	KWG0601824-5	30	41	34	36	49	66
REF-YBMS	KWG0601824-1	48	60	52	40	67	63
REF-YBDMS	KWG0601824-2	39	46	41	28	51	47
Lab Control Sample	KWG0601824-3	48	56	57	54	62	59
Duplicate Lab Control Sample	KWG0601824-4	58	69	69	68	77	73

**Surrogate Recovery Control Limits (%)**

Sur1 = 2-Fluorophenol	11-87	Sur5 = 2,4,6-Tribromophenol	23-113
Sur2 = Phenol-d6	20-99	Sur6 = Terphenyl-d14	39-124
Sur3 = Nitrobenzene-d5	10-99		
Sur4 = 2-Fluorobiphenyl	10-104		

Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Extracted:** 02/02/2006  
**Date Analyzed:** 02/14/2006

**Matrix Spike/Duplicate Matrix Spike Summary**  
**Semi-Volatile Organic Compounds by GC/MS**

**Sample Name:** REF-YB  
**Lab Code:** K0600765-007  
**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low  
**Extraction Lot:** KWG0601824

Analyte Name	Sample Result	REF-YBMS KWG0601824-1 Matrix Spike			REF-YBDMS KWG0601824-2 Duplicate Matrix Spike			%Rec Limits	RPD	RPD Limit
		Result	Expected	%Rec	Result	Expected	%Rec			
Phenol	5.5	137	249	53	104	249	40	21-106	27	40
2-Chlorophenol	ND	129	249	52	101	249	40	23-94	25	40
1,4-Dichlorobenzene	ND	68.2	249	27	58.1	249	23	10-77	16	40
N-Nitrosodi-n-propylamine	ND	133	249	53	99.5	249	40	22-115	29	40
1,2,4-Trichlorobenzene	ND	92.7	249	37	72.9	249	29	10-89	24	40
4-Chloro-3-methylphenol	ND	139	249	56	104	249	42	21-112	28	40
Acenaphthene	ND	122	249	49	85.5	249	34	10-140	35	40
4-Nitrophenol	ND	158	249	63	111	249	45	24-120	35	40
2,4-Dinitrotoluene	ND	159	249	64	115	249	46	28-126	32	40
Pentachlorophenol	ND	148	249	59	113	249	45	10-132	27	40
Pyrene	13	155	249	57	109	249	38	10-173	35	40

Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Extracted:** 02/02/2006  
**Date Analyzed:** 02/14/2006

**Lab Control Spike/Duplicate Lab Control Spike Summary**  
**Semi-Volatile Organic Compounds by GC/MS**

**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low  
**Extraction Lot:** KWG0601824

Analyte Name	Lab Control Sample KWG0601824-3 Lab Control Spike			Duplicate Lab Control Sample KWG0601824-4 Duplicate Lab Control Spike			%Rec Limits	RPD	RPD Limit
	Result	Expected	%Rec	Result	Expected	%Rec			
Bis(2-chloroethyl) Ether	130	250	52	153	250	61	35-100	16	40
Phenol	128	250	51	155	250	62	30-107	19	40
2-Chlorophenol	125	250	50	150	250	60	34-99	18	40
1,3-Dichlorobenzene	119	250	48	128	250	51	38-94	7	40
1,4-Dichlorobenzene	119	250	48	130	250	52	38-92	9	40
1,2-Dichlorobenzene	125	250	50	139	250	55	39-96	10	40
Benzyl Alcohol	124	250	49	148	250	59	32-102	18	40
Bis(2-chloroisopropyl) Ether	128	250	51	148	250	59	30-101	14	40
2-Methylphenol	124	250	49	149	250	59	17-97	18	40
Hexachloroethane	121	250	49	131	250	52	38-98	8	40
N-Nitrosodi-n-propylamine	128	250	51	154	250	62	35-110	19	40
4-Methylphenol	129	250	52	155	250	62	14-99	18	40
Nitrobenzene	134	250	54	160	250	64	35-100	18	40
Isophorone	135	250	54	163	250	65	42-110	18	40
2-Nitrophenol	140	250	56	166	250	66	35-106	17	40
2,4-Dimethylphenol	59.7	250	24	76.7	250	31	10-72	25	40
Bis(2-chloroethoxy)methane	134	250	53	160	250	64	37-99	18	40
2,4-Dichlorophenol	129	250	51	156	250	62	38-98	19	40
Benzoic Acid	31.3	750	4 *	119	750	16	10-83	117 *	40
1,2,4-Trichlorobenzene	125	250	50	146	250	58	37-98	15	40
Naphthalene	132	250	53	154	250	61	39-97	15	40
4-Chloroaniline	93.9	250	38	103	250	41	21-86	9	40
Hexachlorobutadiene	127	250	51	144	250	58	38-96	12	40
4-Chloro-3-methylphenol	135	250	54	160	250	64	35-102	17	40
2-Methylnaphthalene	132	250	53	155	250	62	38-95	17	40
Hexachlorocyclopentadiene	114	250	45	136	250	54	15-96	18	40
2,4,6-Trichlorophenol	135	250	54	161	250	64	39-99	18	40
2,4,5-Trichlorophenol	136	250	54	162	250	65	39-101	17	40
2-Chloronaphthalene	130	250	52	157	250	63	37-102	19	40
2-Nitroaniline	157	250	63	191	250	76	44-105	20	40
Acenaphthylene	143	250	57	173	250	69	46-106	19	40
Dimethyl Phthalate	135	250	54	165	250	66	44-107	19	40
2,6-Dinitrotoluene	167	250	67	205	250	82	48-109	20	40
Acenaphthene	133	250	53	158	250	63	42-98	17	40
3-Nitroaniline	138	250	55	168	250	67	40-106	20	40

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0600765  
**Date Extracted:** 02/02/2006  
**Date Analyzed:** 02/14/2006

**Lab Control Spike/Duplicate Lab Control Spike Summary**  
**Semi-Volatile Organic Compounds by GC/MS**

**Extraction Method:** EPA 3541  
**Analysis Method:** 8270C

**Units:** ug/Kg  
**Basis:** Dry  
**Level:** Low  
**Extraction Lot:** KWG0601824

Analyte Name	Lab Control Sample KWG0601824-3 Lab Control Spike			Duplicate Lab Control Sample KWG0601824-4 Duplicate Lab Control Spike			%Rec Limits	RPD	RPD Limit
	Result	Expected	%Rec	Result	Expected	%Rec			
2,4-Dinitrophenol	141	250	56	202	250	81	21-120	36	40
Dibenzofuran	130	250	52	155	250	62	41-99	18	40
4-Nitrophenol	134	250	54	179	250	72	43-119	29	40
2,4-Dinitrotoluene	151	250	60	182	250	73	50-117	19	40
Fluorene	133	250	53	160	250	64	43-104	18	40
4-Chlorophenyl Phenyl Ether	129	250	52	156	250	62	42-103	19	40
Diethyl Phthalate	138	250	55	166	250	66	45-114	19	40
4-Nitroaniline	146	250	58	178	250	71	41-112	20	40
2-Methyl-4,6-dinitrophenol	170	250	68	203	250	81	37-113	18	40
N-Nitrosodiphenylamine	124	250	50	151	250	61	27-123	20	40
4-Bromophenyl Phenyl Ether	133	250	53	157	250	63	47-103	16	40
Hexachlorobenzene	133	250	53	158	250	63	49-107	17	40
Pentachlorophenol	142	250	57	168	250	67	25-114	17	40
Phenanthrene	137	250	55	165	250	66	48-101	18	40
Anthracene	137	250	55	163	250	65	50-106	17	40
Di-n-butyl Phthalate	142	250	57	171	250	68	49-126	18	40
Fluoranthene	145	250	58	174	250	70	51-119	18	40
Pyrene	143	250	57	175	250	70	51-109	20	40
Butyl Benzyl Phthalate	140	250	56	166	250	66	54-123	17	40
3,3'-Dichlorobenzidine	85.7	250	34	84.8	250	34	10-104	1	40
Benz(a)anthracene	145	250	58	174	250	69	57-115	18	40
Chrysene	146	250	58 *	175	250	70	59-120	18	40
Bis(2-ethylhexyl) Phthalate	177	250	71	170	250	68	52-136	4	40
Di-n-octyl Phthalate	144	250	58	168	250	67	54-127	15	40
Benzo(b)fluoranthene	144	250	58	169	250	68	54-116	16	40
Benzo(k)fluoranthene	146	250	58	170	250	68	56-115	16	40
Benzo(a)pyrene	142	250	57	167	250	67	53-120	16	40
Indeno(1,2,3-cd)pyrene	144	250	58	169	250	67	52-125	16	40
Dibenz(a,h)anthracene	144	250	58	171	250	68	53-122	17	40
Benzo(g,h,i)perylene	141	250	56	164	250	66	45-124	15	40

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Polynuclear Aromatic Hydrocarbons**  
**EPA Method 8270C**

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polynuclear Aromatic Hydrocarbons

**Sample Name:** SW-100  
**Lab Code:** K0600765-008  
**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	0.0082	J	0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
2-Methylnaphthalene	0.0039	J	0.020	0.0027	1	01/31/06	02/03/06	KWG0601710	
Acenaphthylene	ND	U	0.020	0.0018	1	01/31/06	02/03/06	KWG0601710	
Acenaphthene	0.0040	J	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
Dibenzofuran	ND	U	0.020	0.0071	1	01/31/06	02/03/06	KWG0601710	
Fluorene	0.0034	J	0.020	0.0026	1	01/31/06	02/03/06	KWG0601710	
Phenanthrene	0.0092	J	0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
Anthracene	0.0030	J	0.020	0.0011	1	01/31/06	02/03/06	KWG0601710	
Fluoranthene	0.012	J	0.020	0.0024	1	01/31/06	02/03/06	KWG0601710	
Pyrene	0.013	J	0.020	0.0023	1	01/31/06	02/03/06	KWG0601710	
Benz(a)anthracene	ND	U	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Chrysene	0.0048	J	0.020	0.0013	1	01/31/06	02/03/06	KWG0601710	
Benzo(b)fluoranthene	0.0032	J	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
Benzo(k)fluoranthene	0.0020	J	0.020	0.0014	1	01/31/06	02/03/06	KWG0601710	
Benzo(a)pyrene	ND	U	0.020	0.0016	1	01/31/06	02/03/06	KWG0601710	
Indeno(1,2,3-cd)pyrene	ND	U	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Dibenz(a,h)anthracene	ND	U	0.020	0.0017	1	01/31/06	02/03/06	KWG0601710	
Benzo(g,h,i)perylene	ND	U	0.020	0.0037	1	01/31/06	02/03/06	KWG0601710	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	78	24-111	02/03/06	Acceptable
Fluoranthene-d10	76	26-123	02/03/06	Acceptable
Terphenyl-d14	85	25-146	02/03/06	Acceptable

Comments:



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polynuclear Aromatic Hydrocarbons

**Sample Name:** SW-101  
**Lab Code:** K0600765-009  
**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	0.14		0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
2-Methylnaphthalene	0.082		0.020	0.0027	1	01/31/06	02/03/06	KWG0601710	
Acenaphthylene	0.0058	J	0.020	0.0018	1	01/31/06	02/03/06	KWG0601710	
Acenaphthene	0.0097	J	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
Dibenzofuran	ND	U	0.020	0.0071	1	01/31/06	02/03/06	KWG0601710	
Fluorene	0.0076	J	0.020	0.0026	1	01/31/06	02/03/06	KWG0601710	
Phenanthrene	0.012	J	0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
Anthracene	0.0033	J	0.020	0.0011	1	01/31/06	02/03/06	KWG0601710	
Fluoranthene	0.016	J	0.020	0.0024	1	01/31/06	02/03/06	KWG0601710	
Pyrene	0.020	J	0.020	0.0023	1	01/31/06	02/03/06	KWG0601710	
Benz(a)anthracene	ND	U	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Chrysene	0.0035	J	0.020	0.0013	1	01/31/06	02/03/06	KWG0601710	
Benzo(b)fluoranthene	0.0029	J	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
Benzo(k)fluoranthene	0.0019	J	0.020	0.0014	1	01/31/06	02/03/06	KWG0601710	
Benzo(a)pyrene	0.0017	J	0.020	0.0016	1	01/31/06	02/03/06	KWG0601710	
Indeno(1,2,3-cd)pyrene	0.0030	J	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Dibenz(a,h)anthracene	0.0022	J	0.020	0.0017	1	01/31/06	02/03/06	KWG0601710	
Benzo(g,h,i)perylene	ND	U	0.020	0.0037	1	01/31/06	02/03/06	KWG0601710	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	78	24-111	02/03/06	Acceptable
Fluoranthene-d10	78	26-123	02/03/06	Acceptable
Terphenyl-d14	86	25-146	02/03/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polynuclear Aromatic Hydrocarbons

**Sample Name:** SW-102  
**Lab Code:** K0600765-010  
**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	0.21		0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
2-Methylnaphthalene	0.14		0.020	0.0027	1	01/31/06	02/03/06	KWG0601710	
Acenaphthylene	0.0077	J	0.020	0.0018	1	01/31/06	02/03/06	KWG0601710	
Acenaphthene	0.015	J	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
Dibenzofuran	0.0080	J	0.020	0.0071	1	01/31/06	02/03/06	KWG0601710	
Fluorene	0.011	J	0.020	0.0026	1	01/31/06	02/03/06	KWG0601710	
Phenanthrene	0.015	J	0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
Anthracene	0.0050	J	0.020	0.0011	1	01/31/06	02/03/06	KWG0601710	
Fluoranthene	0.022		0.020	0.0024	1	01/31/06	02/03/06	KWG0601710	
Pyrene	0.025		0.020	0.0023	1	01/31/06	02/03/06	KWG0601710	
Benz(a)anthracene	ND	U	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Chrysene	0.0051	J	0.020	0.0013	1	01/31/06	02/03/06	KWG0601710	
Benzo(b)fluoranthene	0.0020	J	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
Benzo(k)fluoranthene	0.0014	J	0.020	0.0014	1	01/31/06	02/03/06	KWG0601710	
Benzo(a)pyrene	ND	U	0.020	0.0016	1	01/31/06	02/03/06	KWG0601710	
Indeno(1,2,3-cd)pyrene	ND	U	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Dibenz(a,h)anthracene	ND	U	0.020	0.0017	1	01/31/06	02/03/06	KWG0601710	
Benzo(g,h,i)perylene	ND	U	0.020	0.0037	1	01/31/06	02/03/06	KWG0601710	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	75	24-111	02/03/06	Acceptable
Fluoranthene-d10	80	26-123	02/03/06	Acceptable
Terphenyl-d14	89	25-146	02/03/06	Acceptable

Comments:

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polynuclear Aromatic Hydrocarbons

**Sample Name:** SW-104  
**Lab Code:** K0600765-011  
**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	0.017	J	0.020	0.0032	1	01/31/06	02/06/06	KWG0601710	
2-Methylnaphthalene	0.0095	J	0.020	0.0027	1	01/31/06	02/06/06	KWG0601710	
Acenaphthylene	ND	U	0.020	0.0018	1	01/31/06	02/06/06	KWG0601710	
Acenaphthene	0.0023	J	0.020	0.0020	1	01/31/06	02/06/06	KWG0601710	
Dibenzofuran	ND	U	0.020	0.0071	1	01/31/06	02/06/06	KWG0601710	
Fluorene	ND	U	0.020	0.0026	1	01/31/06	02/06/06	KWG0601710	
Phenanthrene	0.0048	J	0.020	0.0032	1	01/31/06	02/06/06	KWG0601710	
Anthracene	ND	U	0.020	0.0011	1	01/31/06	02/06/06	KWG0601710	
Fluoranthene	0.0038	J	0.020	0.0024	1	01/31/06	02/06/06	KWG0601710	
Pyrene	0.0030	J	0.020	0.0023	1	01/31/06	02/06/06	KWG0601710	
Benz(a)anthracene	ND	U	0.020	0.0021	1	01/31/06	02/06/06	KWG0601710	
Chrysene	ND	U	0.020	0.0013	1	01/31/06	02/06/06	KWG0601710	
Benzo(b)fluoranthene	ND	U	0.020	0.0020	1	01/31/06	02/06/06	KWG0601710	
Benzo(k)fluoranthene	ND	U	0.020	0.0014	1	01/31/06	02/06/06	KWG0601710	
Benzo(a)pyrene	ND	U	0.020	0.0016	1	01/31/06	02/06/06	KWG0601710	
Indeno(1,2,3-cd)pyrene	ND	U	0.020	0.0021	1	01/31/06	02/06/06	KWG0601710	
Dibenz(a,h)anthracene	ND	U	0.020	0.0017	1	01/31/06	02/06/06	KWG0601710	
Benzo(g,h,i)perylene	ND	U	0.020	0.0037	1	01/31/06	02/06/06	KWG0601710	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	76	24-111	02/06/06	Acceptable
Fluoranthene-d10	68	26-123	02/06/06	Acceptable
Terphenyl-d14	87	25-146	02/06/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006

## Polynuclear Aromatic Hydrocarbons

**Sample Name:** SW-105  
**Lab Code:** K0600765-012  
**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	0.0080	J	0.020	0.0032	1	01/31/06	02/06/06	KWG0601710	
2-Methylnaphthalene	0.0027	J	0.020	0.0027	1	01/31/06	02/06/06	KWG0601710	
Acenaphthylene	ND	U	0.020	0.0018	1	01/31/06	02/06/06	KWG0601710	
Acenaphthene	0.0027	J	0.020	0.0020	1	01/31/06	02/06/06	KWG0601710	
Dibenzofuran	ND	U	0.020	0.0071	1	01/31/06	02/06/06	KWG0601710	
Fluorene	ND	U	0.020	0.0026	1	01/31/06	02/06/06	KWG0601710	
Phenanthrene	0.0051	J	0.020	0.0032	1	01/31/06	02/06/06	KWG0601710	
Anthracene	0.0013	J	0.020	0.0011	1	01/31/06	02/06/06	KWG0601710	
Fluoranthene	0.0049	J	0.020	0.0024	1	01/31/06	02/06/06	KWG0601710	
Pyrene	0.0041	J	0.020	0.0023	1	01/31/06	02/06/06	KWG0601710	
Benz(a)anthracene	ND	U	0.020	0.0021	1	01/31/06	02/06/06	KWG0601710	
Chrysene	0.0016	J	0.020	0.0013	1	01/31/06	02/06/06	KWG0601710	
Benzo(b)fluoranthene	ND	U	0.020	0.0020	1	01/31/06	02/06/06	KWG0601710	
Benzo(k)fluoranthene	ND	U	0.020	0.0014	1	01/31/06	02/06/06	KWG0601710	
Benzo(a)pyrene	ND	U	0.020	0.0016	1	01/31/06	02/06/06	KWG0601710	
Indeno(1,2,3-cd)pyrene	ND	U	0.020	0.0021	1	01/31/06	02/06/06	KWG0601710	
Dibenz(a,h)anthracene	ND	U	0.020	0.0017	1	01/31/06	02/06/06	KWG0601710	
Benzo(g,h,i)perylene	ND	U	0.020	0.0037	1	01/31/06	02/06/06	KWG0601710	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	76	24-111	02/06/06	Acceptable
Fluoranthene-d10	77	26-123	02/06/06	Acceptable
Terphenyl-d14	83	25-146	02/06/06	Acceptable

Comments: \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Ocean water

**Service Request:** K0600765  
**Date Collected:** NA  
**Date Received:** NA

## Polynuclear Aromatic Hydrocarbons

**Sample Name:** Method Blank  
**Lab Code:** KWG0601710-4  
**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
2-Methylnaphthalene	ND	U	0.020	0.0027	1	01/31/06	02/03/06	KWG0601710	
Acenaphthylene	ND	U	0.020	0.0018	1	01/31/06	02/03/06	KWG0601710	
Acenaphthene	ND	U	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
Dibenzofuran	ND	U	0.020	0.0071	1	01/31/06	02/03/06	KWG0601710	
Fluorene	ND	U	0.020	0.0026	1	01/31/06	02/03/06	KWG0601710	
Phenanthrene	ND	U	0.020	0.0032	1	01/31/06	02/03/06	KWG0601710	
Anthracene	ND	U	0.020	0.0011	1	01/31/06	02/03/06	KWG0601710	
Fluoranthene	ND	U	0.020	0.0024	1	01/31/06	02/03/06	KWG0601710	
Pyrene	ND	U	0.020	0.0023	1	01/31/06	02/03/06	KWG0601710	
Benz(a)anthracene	ND	U	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Chrysene	ND	U	0.020	0.0013	1	01/31/06	02/03/06	KWG0601710	
Benzo(b)fluoranthene	ND	U	0.020	0.0020	1	01/31/06	02/03/06	KWG0601710	
<b>Benzo(k)fluoranthene</b>	<b>0.0017</b>	<b>J</b>	0.020	0.0014	1	01/31/06	02/03/06	KWG0601710	
Benzo(a)pyrene	ND	U	0.020	0.0016	1	01/31/06	02/03/06	KWG0601710	
Indeno(1,2,3-cd)pyrene	ND	U	0.020	0.0021	1	01/31/06	02/03/06	KWG0601710	
Dibenz(a,h)anthracene	ND	U	0.020	0.0017	1	01/31/06	02/03/06	KWG0601710	
Benzo(g,h,i)perylene	ND	U	0.020	0.0037	1	01/31/06	02/03/06	KWG0601710	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	77	24-111	02/03/06	Acceptable
Fluoranthene-d10	82	26-123	02/03/06	Acceptable
Terphenyl-d14	93	25-146	02/03/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Water

**Service Request:** K0600765

**Surrogate Recovery Summary**  
**Polynuclear Aromatic Hydrocarbons**

**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** PERCENT  
**Level:** Low

<u>Sample Name</u>	<u>Lab Code</u>	<u>Sur1</u>	<u>Sur2</u>	<u>Sur3</u>
SW-100	K0600765-008	78	76	85
SW-101	K0600765-009	78	78	86
SW-102	K0600765-010	75	80	89
SW-104	K0600765-011	76	68	87
SW-105	K0600765-012	76	77	83
Method Blank	KWG0601710-4	77	82	93
Lab Control Sample	KWG0601710-3	79	81	79
Duplicate Lab Control Sample	KWG0601710-5	81	82	81

---

**Surrogate Recovery Control Limits (%)**

Sur1 = Fluorene-d10	24-111
Sur2 = Fluoranthene-d10	26-123
Sur3 = Terphenyl-d14	25-146

---

Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

## COLUMBIA ANALYTICAL SERVICES, INC.

## QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Ocean water

**Service Request:** K0600765  
**Date Extracted:** 01/31/2006  
**Date Analyzed:** 02/03/2006

**Lab Control Spike/Duplicate Lab Control Spike Summary**  
**Polynuclear Aromatic Hydrocarbons**

**Extraction Method:** EPA 3520C  
**Analysis Method:** 8270C SIM

**Units:** ug/L  
**Basis:** NA  
**Level:** Low  
**Extraction Lot:** KWG0601710

Analyte Name	Lab Control Sample KWG0601710-3 Lab Control Spike			Duplicate Lab Control Sample KWG0601710-5 Duplicate Lab Control Spike			%Rec Limits	RPD	RPD Limit
	Result	Expected	%Rec	Result	Expected	%Rec			
Naphthalene	1.90	2.50	76	1.91	2.50	76	32-124	1	30
2-Methylnaphthalene	1.69	2.50	68	1.72	2.50	69	19-133	2	30
Acenaphthylene	2.05	2.50	82	2.11	2.50	84	36-128	3	30
Acenaphthene	2.02	2.50	81	2.08	2.50	83	36-126	3	30
Dibenzofuran	1.86	2.50	74	1.90	2.50	76	10-167	2	30
Fluorene	1.98	2.50	79	2.01	2.50	80	41-130	2	30
Phenanthrene	2.13	2.50	85	2.13	2.50	85	43-129	0	30
Anthracene	2.10	2.50	84	2.05	2.50	82	36-131	2	30
Fluoranthene	2.10	2.50	84	2.12	2.50	85	45-139	1	30
Pyrene	2.44	2.50	98	2.49	2.50	100	38-143	2	30
Benz(a)anthracene	2.12	2.50	85	2.15	2.50	86	45-131	2	30
Chrysene	2.33	2.50	93	2.37	2.50	95	47-132	1	30
Benzo(b)fluoranthene	2.48	2.50	99	2.48	2.50	99	51-135	0	30
Benzo(k)fluoranthene	2.37	2.50	95	2.56	2.50	102	46-139	8	30
Benzo(a)pyrene	2.38	2.50	95	2.46	2.50	98	40-138	3	30
Indeno(1,2,3-cd)pyrene	1.92	2.50	77	1.73	2.50	69	35-148	11	30
Dibenz(a,h)anthracene	1.86	2.50	74	1.69	2.50	68	42-143	10	30
Benzo(g,h,i)perylene	2.15	2.50	86	2.03	2.50	81	42-139	6	30

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** SD-100  
**Lab Code:** K0601413-001  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.25	0.0075	5	03/01/06	03/09/06	KWG0603363	*
Tri-n-butyltin	0.065	JD	0.10	0.0030	5	03/01/06	03/09/06	KWG0603363	*
Di-n-butyltin	0.013	JD	0.25	0.0028	5	03/01/06	03/09/06	KWG0603363	*
n-Butyltin	ND	U	0.25	0.0085	5	03/01/06	03/09/06	KWG0603363	*

\* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	85	23-137	03/09/06	Acceptable

**Comments:** \_\_\_\_\_



## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** SD-101  
**Lab Code:** K0601413-002  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.25	0.0075	5	03/01/06	03/09/06	KWG0603363	*
Tri-n-butyltin	0.081	JD	0.10	0.0030	5	03/01/06	03/09/06	KWG0603363	*
Di-n-butyltin	0.0077	JD	0.25	0.0028	5	03/01/06	03/09/06	KWG0603363	*
n-Butyltin	ND	U	0.25	0.0085	5	03/01/06	03/09/06	KWG0603363	*

\* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	64	23-137	03/09/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** SD-102  
**Lab Code:** K0601413-003  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.25	0.0075	5	03/01/06	03/09/06	KWG0603363	*
Tri-n-butyltin	0.058	JD	0.10	0.0030	5	03/01/06	03/09/06	KWG0603363	*
Di-n-butyltin	0.0082	JD	0.25	0.0028	5	03/01/06	03/09/06	KWG0603363	*
n-Butyltin	ND	U	0.25	0.0085	5	03/01/06	03/09/06	KWG0603363	*

\* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	78	23-137	03/09/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** SD-103  
**Lab Code:** K0601413-004  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.25	0.0075	5	03/01/06	03/09/06	KWG0603363	*
Tri-n-butyltin	0.028	JD	0.10	0.0030	5	03/01/06	03/09/06	KWG0603363	*
Di-n-butyltin	0.0039	JD	0.25	0.0028	5	03/01/06	03/09/06	KWG0603363	*
n-Butyltin	ND	U	0.25	0.0085	5	03/01/06	03/09/06	KWG0603363	*

\* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	97	23-137	03/09/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** SD-104  
**Lab Code:** K0601413-005  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.050	0.0015	1	03/01/06	03/07/06	KWG0603363	*
Tri-n-butyltin	0.013	J	0.020	0.00060	1	03/01/06	03/07/06	KWG0603363	*
Di-n-butyltin	0.0023	J	0.050	0.00055	1	03/01/06	03/07/06	KWG0603363	*
n-Butyltin	ND	U	0.050	0.0017	1	03/01/06	03/07/06	KWG0603363	*

\* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	83	23-137	03/07/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** REF-EBB  
**Lab Code:** K0601413-006  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.050	0.0015	1	03/01/06	03/07/06	KWG0603363	*
Tri-n-butyltin	0.013	J	0.020	0.00060	1	03/01/06	03/07/06	KWG0603363	*
Di-n-butyltin	0.0037	J	0.050	0.00055	1	03/01/06	03/07/06	KWG0603363	*
n-Butyltin	0.0019	J	0.050	0.0017	1	03/01/06	03/07/06	KWG0603363	*

\* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	92	23-137	03/07/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413  
**Date Collected:** 01/26/2006  
**Date Received:** 01/28/2006  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** REF-YB  
**Lab Code:** K0601413-007  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.050	0.0015	1	03/01/06	03/07/06	KWG0603363	*
Tri-n-butyltin	0.010	J	0.020	0.00060	1	03/01/06	03/07/06	KWG0603363	*
Di-n-butyltin	0.0024	J	0.050	0.00055	1	03/01/06	03/07/06	KWG0603363	*
n-Butyltin	ND	U	0.050	0.0017	1	03/01/06	03/07/06	KWG0603363	*

\* See Case Narrative

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	86	23-137	03/07/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

## Analytical Results

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Aqueous equip b

**Service Request:** K0601413  
**Date Collected:** NA  
**Date Received:** NA  
**Date Prepared:** 02/28/2006

**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Sample Name:** Method Blank  
**Lab Code:** KWG0603363-3  
**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Tetra-n-butyltin	ND	U	0.050	0.0015	1	03/01/06	03/07/06	KWG0603363	
Tri-n-butyltin	0.012	J	0.020	0.00060	1	03/01/06	03/07/06	KWG0603363	
Di-n-butyltin	0.0015	J	0.050	0.00055	1	03/01/06	03/07/06	KWG0603363	
n-Butyltin	ND	U	0.050	0.0017	1	03/01/06	03/07/06	KWG0603363	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tri-n-propyltin	100	23-137	03/07/06	Acceptable

**Comments:** \_\_\_\_\_

## COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Soil

**Service Request:** K0601413

**Surrogate Recovery Summary**  
**Extraction Method Specified in Analytical Method**  
**Butyltins in Porewater (as cation)**

**Preparation Method:** METHOD  
**Extraction Method:** EPA 3520C  
**Analysis Method:** Krone

**Units:** PERCENT  
**Level:** Low

<u>Sample Name</u>	<u>Lab Code</u>	<u>Sur1</u>
SD-100	K0601413-001	85 D
SD-101	K0601413-002	64 D
SD-102	K0601413-003	78 D
SD-103	K0601413-004	97 D
SD-104	K0601413-005	83
REF-EBB	K0601413-006	92
REF-YB	K0601413-007	86
Method Blank	KWG0603363-3	100
Lab Control Sample	KWG0603363-1	96
Duplicate Lab Control Sample	KWG0603363-2	89

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**Surrogate Recovery Control Limits (%)**

Sur1 = Tri-n-propyltin 23-137

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Results flagged with an asterisk (\*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.



## COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

**Client:** Kennedy/Jenks Consultants, Incorporated  
**Project:** Astoria Area-Wide/0592004.00  
**Sample Matrix:** Aqueous equip b

**Service Request:** K0601413  
**Date Prepared:** 02/28/2006  
**Date Extracted:** 03/01/2006  
**Date Analyzed:** 03/07/2006

**Lab Control Spike/Duplicate Lab Control Spike Summary**  
**Butyltins in Porewater (as cation)**

**Extraction Method:** METHOD/EPA 3520C  
**Analysis Method:** Krone

**Units:** ug/L  
**Basis:** NA  
**Level:** Low  
**Extraction Lot:** KWG0603363

Analyte Name	Lab Control Sample KWG0603363-1 Lab Control Spike			Duplicate Lab Control Sample KWG0603363-2 Duplicate Lab Control Spike			%Rec Limits	RPD	RPD Limit
	Result	Expected	%Rec	Result	Expected	%Rec			
Tetra-n-butyltin	0.439	0.500	88	0.429	0.500	86	10-104	2	30
Tri-n-butyltin	0.477	0.446	107	0.403	0.446	90	24-129	17	30
Di-n-butyltin	0.277	0.384	72	0.258	0.384	67	21-119	7	30
n-Butyltin	0.251	0.312	81	0.277	0.312	89	28-143	10	30

Results flagged with an asterisk (\*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

## Appendix D

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### Laboratory Bioassay Reports

**Report**

**of**

**Test No. 738-1**

***Eohaustorius estuarius* 10-Day Toxicity  
Test of Marine Sediments**

**Submitted to**

**Kennedy/Jenks Consultants  
200 S.W. Market St., Suite 500  
Portland, OR 97201**

**Submitted by**

**Northwestern Aquatic Sciences  
3814 Yaquina Bay Road  
P.O. Box 1437  
Newport, OR 97365**

**June 13, 2006**

## TOXICITY TEST REPORT

## TEST IDENTIFICATION

Test No.: 738-1

Title: *Eohaustorius estuarius* 10-day sediment toxicity test of estuarine sediments.

Protocol: NAS-XXX-EE4, February 20, 1992. Rev. 3 (March 1, 2005). Based on: Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments (PSEP 1995), with modifications as specified by the Dredged Material Management Program (DMMP, formerly Puget Sound Dredged Disposal Analysis Program or PSDDA).

## STUDY MANAGEMENT

Study Sponsor: Kennedy/Jenks Consultants, 200 S.W. Market St., Suite 500, Portland, OR 97201

Sponsor's Study Monitor: Dr. Taku Fuji

Testing Laboratory: Northwestern Aquatic Sciences, P.O. Box 1437, Newport, Oregon 97365.

Test Location: Newport Laboratory.

Laboratory's Study Personnel: M.S. Redmond, M.S., Proj. Mngr./ Study Dir.; L.K. Nemeth, B.A., M.B.A., QA Officer; R.S. Caldwell, Ph.D., Sr. Aq. Toxicol.; G.J. Irissarri, B.S., Aq. Toxicol.; G.A. Buhler, B.S., Aq. Toxicol.; W.T. Montgomery, A.A., Sr. Tech.; S. J. Gage, B.A., Tech.; G. Hutchinson, B.S., Tech.

Study Schedule:

Test Beginning: 2-17-06, 1130 hrs.

Test Ending: 2-27-06, 1100 hrs.

Disposition of Study Records: All specimens, raw data, reports and other study records are stored according to Good Laboratory Practice regulations at Northwestern Aquatic Sciences, 3814 Yaquina Bay Rd., Newport, OR 97365.

Good Laboratory Practices: The test was conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

Statement of Quality Assurance: The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with the protocol and standard operating procedures. This report is an accurate reflection of the raw data.

## TEST MATERIAL

Control Sediment: Control sediment (NAS Sample #0438G) was collected from the *Eohaustorius estuarius* amphipod collection site in lower Yaquina Bay, Oregon, on 2-14-06. Interstitial salinity was 5.0 ‰. The sediment was sieved through a 0.5-mm stainless steel screen and stored at 4°C in the dark.

Test Sediments: Five test sediments and two reference sediments were tested. Details follow:

NAS Sample No.	0421G	0422G	0423G	0424G
Sample Description	SD-100	SD-101	SD-102	SD-103
Collection Date	1-26-06	1-26-06	1-26-06	1-26-06
Receipt Date	1-27-06	1-27-06	1-27-06	1-27-06
Interstitial Salinity (‰)	1.5	3.0	1.0	4.5
NAS Sample No.	0425G	0426G	0427G	
Sample Description	SD-104	REF-EBB	REF-YB	
Collection Date	1-26-06	1-26-06	1-26-06	
Receipt Date	1-27-06	1-27-06	1-27-06	
Interstitial Salinity (‰)	5.0	5.0	7.0	

Storage: Upon receipt, sample containers were completely full(no headspace). Samples were stored at 4°C in the dark.

Treatments: The samples were homogenized by mixing with stainless steel implements.

**TEST WATER**

Source: Yaquina Bay, Oregon

Date of Collection: 2-15-06

Water Quality: Salinity 28.0‰

Pretreatment: Filtered to  $\leq 0.40 \mu\text{m}$ , salinity-adjusted with MilliQ® deionized water, aerated.

**TEST ORGANISMS**

Species: *Eohaustorius estuarius*, amphipod

Age: adult

Source: Yaquina Bay, Oregon

Acclimation: Amphipods were collected on 2-14-06 at interstitial water conditions of 6.0°C and 18.0‰. They were acclimated to test temperature and salinity over three days before addition to the test. Average test conditions during this time were: temperature,  $13.6 \pm 0.7^\circ\text{C}$ ; pH,  $7.9 \pm 0.1$ ; salinity,  $27.5 \pm 2.7\text{‰}$ ; and dissolved oxygen  $8.8 \pm 0.3 \text{ mg/L}$ . The photoperiod was constant light.

**TEST PROCEDURES AND CONDITIONS**

The following is an abbreviated statement of the test procedures and a statement of the test conditions actually employed. See the test protocol (Appendix I) for a more detailed description of the test procedures used in this study.

Test Chambers: 1 L covered borosilicate glass beakers

Test Volumes: 175 ml of test, reference, or control sediment; 950 ml total volume.

Replicates/Treatment: 5 (plus one water quality replicate, and one additional sacrificial replicate used to measure interstitial water ammonia-N on day 0.)

Salinity adjustment: none

Organisms/Treatment: 100 (20/replicate); all beakers received test organisms except those sacrificed on day 0.

Water Volume Changes per 24 hr: None.

Aeration: Yes, at least 2 cm above the sediment surface.

Feeding: None.

Acceptance Criteria: Results are valid if mean control mortality does not exceed 10%, and does not exceed 20% in any one control replicate.

Performance Criteria: For PSDDA testing, the mean mortality in the reference sediment must not exceed the mean mortality in the control sediment by more than 20%.

Effects Criteria: 1) mortality after 10 days, 2) daily emergence of amphipods from the test sediments, and 3) failure of surviving amphipods to rebury at the end of the exposure period. Death is defined as no visible appendage movement or response to tactile stimulation. Unrecovered animals at the end of the exposure period were considered dead.

Water Quality and Other Test Conditions: The temperature, dissolved oxygen, salinity, and pH, were measured in the water quality replicate test chamber daily. Total dissolved sulfide and total ammonia-N were measured in the overlying water of the water quality replicate test chamber on days 0 and 10. Interstitial total ammonia-N and total dissolved sulfide were measured in bulk sediments. Interstitial total ammonia-N was also measured in a sacrificial beaker on test day 0, and from the water quality beaker on test day 10. Interstitial water samples were obtained by centrifugation or by settling. Total soluble sulfide and total ammonia-N were measured using Hach reagents based on the methylene blue (EPA Method 376.2) and salicylate (Clin. Chim. Acta 14:403, 1996) colorimetric methods, respectively; samples were not distilled prior to analysis. Un-ionized ammonia-N was computed using "Un-ionized Ammonia Calculator", v1.0 (Dr. Landon Ross, Florida Department of Environmental Protection). The photoperiod was constant light.

## DATA ANALYSIS METHODS

The percent amphipod mortality, percent of surviving amphipods failing to rebury at the end of the test, and percent total effective mortality were determined from the final observations according to the formulas:

Percent Mortality =  $100 \times ([\text{initial amphipods} - \text{surviving amphipods}]/\text{initial amphipods})$

Percent Survivors not Reburied =  $100 \times ([\text{surviving amphipods} - \text{number survivors reburied}]/\text{surviving amphipods})$

Percent Total Effective Mortality =  $100 \times ([\text{initial amphipods} - \text{surviving amphipods}] + [\text{surviving amphipods} - \text{number survivors reburied}]/\text{initial amphipods})$

Another endpoint was the sum of observed daily sediment emergence events in a test beaker throughout the test. Control and treatment means and standard deviations for the biological endpoints described above and for water quality data were computed using Microsoft EXCEL 2000. The software used for statistical comparisons was BioStat (Beta v.4.1 (EXCEL)) bioassay software developed by the U.S. Army Corps of Engineers, Seattle District. Percent mortality in each test sediment was compared against that in the reference sediment. Generally, an arcsine square root transformation was performed on percentage data before analysis. In some cases, a rank order transformation was necessary. Following determination of normality and homogeneity of variances, a one-tailed Student T-test, Approximate T-test, One-sample T-test, Mann Whitney test, or Rankit Analysis was conducted at the 0.05 level of significance.

## PROTOCOL DEVIATIONS

1. Several salinity measurements were outside the protocol-specified range of  $28.0 \pm 1.0\text{‰}$  (minimum 25.0‰, maximum 31.0‰).
2. Six temperature readings, on days 5 and 6, exceeded the protocol-specified range of  $15.0 \pm 1.0^\circ\text{C}$  (maximum  $16.3^\circ\text{C}$ ).
3. On days 3 and 4, dissolved oxygen readings well above saturation suggested that the instrument was inadvertently used on a freshwater setting. Therefore dissolved oxygen measurements from those two days were eliminated from further analysis.
4. At test termination, a water quality beaker was accidentally sieved. The amphipod counts from the water quality beaker were therefore used for biological endpoint calculations, and the biological endpoint beaker was used for interstitial water quality measurements and overlying ammonia and sulfide measurements.

## REFERENCE TOXICANT TEST

A reference toxicant test with sodium dodecyl sulfate (SDS) was performed to evaluate the performance of the test organisms used in the sediment toxicity test. The performance is evaluated by comparing the results of this test with historical results obtained at the laboratory. A summary of the reference toxicant test result is given below. Reference toxicant test raw data and the applicable control chart are included in Appendix II.

Test No.: 999-2085

Reference Toxicant and Source: sodium dodecyl sulfate, Sigma Chem Lot #17H0459, 1.0 mg/ml stock prepared 2-17-06

Test Date: 2-17-06

Dilution Water Used: Yaquina Bay, Oregon, seawater

Result: 48-hr LC50, 73.9 mg SDS/L. This result is within the laboratory's control chart warning limits (66.4 – 120 mg/L).

## RESULTS AND DISCUSSION

Observations of overlying water quality parameters during the test are summarized in Table 1. Interstitial water quality measurements during the test are summarized in Table 2. Individual water quality measurements are located in the raw data (Appendix II).

Except as noted above, all measurements of standard water quality parameters were within protocol-specified ranges. Dissolved sulfide was not detected in the overlying water (detection limit 0.1 mg/L). Total ammonia-N

concentrations in the overlying water ranged from 0.1 mg/L to 4.5 mg/L (maximum 0.311 mg/L un-ionized ammonia).

Interstitial total ammonia-N concentrations in the bulk sediment ranged from 3.0 to 14.1 mg/L (maximum 0.202 mg/L un-ionized ammonia), with no detectable sulfide concentrations (detection limit 0.1 mg/L). In samples taken during the bioassay, interstitial total ammonia-N concentrations ranged from 0.7 mg/L to 44.1 mg/L, with a maximum un-ionized ammonia concentration of 0.106 mg/L.

Table 3 shows the effects of test sediment exposures on emergence, mortality, and reburial. The test met the acceptability criterion ( $\leq 10\%$ ) for mean control mortality; mean mortality in the control was 1.0%. In addition, replicate control mortality was 0.0, 5.0, 0.0, 0.0, and 0.0%; therefore, the control replicate acceptability criterion was met ( $\leq 20\%$  in any one replicate). The reference toxicant test result (73.9 mg SDS/L) was within the laboratory's control chart warning limits. However, mean mortality in both reference sediments exceeded the mean mortality in the control sediment (1.0%) by more than 20%. Mean mortality in reference sediments REF-EBB and REF-YB was 23.0% and 61.0%, respectively. REF-EBB was used for statistical comparisons, by direction of the client.

The test control acceptance criteria were met, and positive control performance was within the laboratory's acceptance limits. However, the reference sediment performance criterion was slightly exceeded. It is concluded, therefore, that the test has developed provisionally acceptable data for use in making management decisions.

Percent mortality in test sediments SD-100, SD-101, SD-102, and SD-103 was significantly ( $P=0.05$ ) higher than that in the reference sediment REF-EBB (Table 3).

Interpretation was based on guidelines from the "Dredged Material Evaluation and Disposal Procedures, A User's Manual for the Puget Sound Dredged Disposal Analysis (PSDDA) Program," February 2000 (U.S. Army Corps of Engineers, Seattle District; U.S. Environmental Protection Agency, Region 10, Washington Department of Natural Resources, Washington Department of Ecology). For a test sediment to fail under these guidelines, under the single hit rule, the mean test mortality must be  $>20\%$  absolute over the mean negative control response, and  $>10\%$  (dispersive) or  $>30\%$  (nondispersive) absolute over the mean reference sediment response, and statistically different ( $\alpha = 0.05$ ) from the reference sediment. Test sediments SD-100, SD-101, SD-102, and SD-103 failed the single hit rule under these guidelines. Test sediment SD-104 passed under the single hit rule (Table 4).

#### STUDY APPROVAL

*Michelle S. Redmond* 6/13/06  
Project Manager/ Study Director Date

*Julie R. Frone for*  
*Linda Nemeth* 6-13-06  
Quality Assurance Unit Date

*Richard A. Caldwell* 6/13/06  
Laboratory Director Date

Table 1. Summary of overlying water quality conditions during tests of the amphipod, *Eohaustorius estuarius*, exposed to estuarine sediments.

Parameter	Mean $\pm$ SD	Minimum	Maximum	N
Temperature ( $^{\circ}$ C)	15.4 $\pm$ 0.5	14.4	16.3	88
pH	7.8 $\pm$ 0.2	7.0	8.1	88
Salinity (‰)	27.8 $\pm$ 1.7	25.0	31.0	88
Dissolved oxygen (mg/L)	8.0 $\pm$ 0.3	7.4	8.6	72
Total soluble sulfide (mg/L)	---	<0.1	<0.1	16
Total ammonia-N (mg/L)	---	0.1	4.5	16
Un-ionized ammonia (mg/L)	---	0.004	0.311	15

Table 2. Summary of interstitial water quality conditions during tests of the amphipod, *Eohaustorius estuarius*, exposed to estuarine sediments.

Parameter	Mean $\pm$ SD	Minimum	Maximum	N
Salinity (‰)	21.4 $\pm$ 6.4	13.0	29.0	16
pH	6.8 $\pm$ 0.4	6.4	7.6	16
Total ammonia-N (mg/L)	---	0.7	44.1	16
Un-ionized ammonia (mg/L)	---	0.005	0.106	15

Table 3. Means and standard deviations (n=5) of sediment emergence, percent mortality, percent of survivors failing to rebury, and percent total effective mortality of *Eohaustorius estuarius* exposed to estuarine sediments. An "\*" indicates that the percent mortality in a test sediment was significantly higher than that in reference sediment REF-EBB (p<0.05).

Sample description	Emergence <sup>1</sup> (no./replicate)	Percent mortality	Percent Survivors Failing to Rebury	Percent Total Effective Mortality
Control (NAS #0438G)	0.0 $\pm$ 0.0	1.0 $\pm$ 2.2	0.0 $\pm$ 0.0	1.0 $\pm$ 2.2
REF-EBB (NAS #0426G) <sup>2</sup>	4.2 $\pm$ 3.2	23.0 $\pm$ 13.5	0.0 $\pm$ 0.0	23.0 $\pm$ 13.5
REF-YB (NAS #0427G) <sup>2</sup>	1.4 $\pm$ 1.9	61.0 $\pm$ 6.5	0.0 $\pm$ 0.0	61.0 $\pm$ 6.5
SD-100 (NAS #0421G)	66.2 $\pm$ 20.2	100.0 $\pm$ 0.0	*	100.0 $\pm$ 0.0
SD-101 (NAS #0422G)	79.2 $\pm$ 21.1	100.0 $\pm$ 0.0	*	100.0 $\pm$ 0.0
SD-102 (NAS #0423G)	85.2 $\pm$ 19.0	100.0 $\pm$ 0.0	*	100.0 $\pm$ 0.0
SD-103 (NAS #0424G)	15.6 $\pm$ 9.4	61.0 $\pm$ 8.2	*	61.0 $\pm$ 8.2
SD-104 (NAS #0425G)	5.8 $\pm$ 5.4	24.0 $\pm$ 6.5	0.0 $\pm$ 0.0	24.0 $\pm$ 6.5

<sup>1</sup> Daily emergence counts include all amphipods observed on or above the sediment surface, whether living or dead.<sup>2</sup> REF-EBB was used as the reference sediment; REF-YB was not used for statistical comparisons.



Table 4. Single-hit criteria interpretation of *Eohaustorius* test data. REF-EBB was used as the reference sediment.

Sample description	Percent mortality	Significantly different from REF-EBB at $\alpha = 0.05$ ?	Percent difference over negative control	Percent difference over REF-EBB	Failure under 1-hit dispersive rule?	Failure under 1-hit nondispersive rule?
Control (NAS #0438G)	$1.0 \pm 2.2$	---	---	---	---	---
REF-EBB (NAS #0426G) <sup>1</sup>	$23.0 \pm 13.5$	---	22.0	---	---	---
REF-YB (NAS #0427G) <sup>1</sup>	$61.0 \pm 6.5$	---	60.0	---	---	---
SD-100 (NAS #0421G)	$100.0 \pm 0.0$	YES	99.0	77.0	YES	YES
SD-101 (NAS #0422G)	$100.0 \pm 0.0$	YES	99.0	77.0	YES	YES
SD-102 (NAS #0423G)	$100.0 \pm 0.0$	YES	99.0	77.0	YES	YES
SD-103 (NAS #0424G)	$61.0 \pm 8.2$	YES	60.0	38.0	YES	YES
SD-104 (NAS #0425G)	$24.0 \pm 6.5$	NO	23.0	1.0	NO	NO

<sup>1</sup> REF-EBB was used as the reference sediment; REF-YB was not used for statistical comparisons.

## APPENDIX I

## PROTOCOL

TEST PROTOCOL

**AMPHIPOD, *EOHAUSTORIUS ESTUARIUS*,  
10-DAY SOLID PHASE SEDIMENT BIOASSAY**

1. INTRODUCTION

- 1.1 Purpose of Study: The purpose of this study is to identify marine test sediments that are toxic to an estuarine amphipod.
- 1.2 Summary of Method: The 10-day static test is performed using adult amphipods obtained from a wild population. Test sediments are placed in the bottom of 1-liter glass beakers used as test vessels that are then filled with clean seawater. Five replicate containers for each test sediment, reference site sediment, and the collection site control sediment, each containing 20 test organisms, are employed. Survival, emergence from the sediment during exposure, and failure to rebury in clean sediment after the test are the response criteria used. The mean and standard deviation for each treatment and test endpoint are given in the final report. Between-treatment statistical comparisons may be made, where each treatment is compared to the control and/or reference sediment. This protocol is based on PSEP (1995) guidelines, PSDDA (PSDDA 1989, U.S. ACOE et al. 2000) modifications, SMS (WDOE 2003) and ASTM E-1367 (ASTM 2004).

2. STUDY MANAGEMENT

- 2.1 Sponsor's Name and Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 2.2 Sponsor's Study Monitor:

\_\_\_\_\_

- 2.3 Name of Testing Laboratory:

Northwestern Aquatic Sciences  
3814 Yaquina Bay Road, P.O. Box 1437  
Newport, OR 97365

- 2.4 Test Location: Newport Laboratory

- 2.5 Laboratory's Personnel to be Assigned to the Study:

Project Manager/Technical Director: \_\_\_\_\_  
Quality Assurance Officer: \_\_\_\_\_  
Aquatic Toxicologist: \_\_\_\_\_  
Aquatic Toxicologist: \_\_\_\_\_

- 2.6 Proposed Testing Schedule: Tests should begin within 2 weeks (8 weeks with samples under nitrogen for PSDDA or SMS) of sample collection. A reference toxicant test is run concurrently.

- 2.7 Good Laboratory Practices: The test is conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

3. TEST MATERIAL

The test materials are marine or estuarine sediments. *E. estuarinus* is a desirable test species for sediments with interstitial water salinity of 2-28 ppt, and the use of the *E. estuarinus* bioassay is preferred for sediments with salinities <25 ppt. The collected sediments are placed in a suitable container for shipping and storage. The preferred container is a solvent and acid cleaned 1 L glass jar fitted with a TFE-lined screw cap. The jars are filled completely so that there is no air space. At the laboratory, the samples may be stored at 4°C in the dark in the original sealed containers for up to 2 weeks (8 weeks with no headspace or with samples under nitrogen for PSDDA

or SMS) prior to testing. The negative control sediment is from a clean site, normally the amphipod collection site. In addition, one or more reference sediments, clean sediments with physical characteristics similar to the test sediments, may also be employed.

#### 4. TEST WATER

Test water is filtered Yaquina Bay seawater adjusted to the selected test salinity. The water is pumped from Yaquina Bay into a 6000 gal seasoned fiberglass reservoir from which it is supplied under pump pressure to the laboratory. Filtration is accomplished using a sand filter followed by 5  $\mu$ m, 1  $\mu$ m, and 0.40  $\mu$ m cartridge filters. An alternative seawater supply of similar quality may be used. Seawater should be held at  $\leq 15^{\circ}\text{C}$  for  $\leq 2$  days prior to test initiation.

#### 5. TEST ORGANISMS

5.1 Species: Estuarine amphipod, *Eohaustorius estuarius*.

5.2 Source: Field collected from the lower portion of Beaver Creek, OR, or Yaquina Bay, OR in the intertidal zone. Interstitial water salinity and temperature are measured at the collection site. The sediments are sieved in the field using a 1.0 mm screen and the recovered amphipods, along with miscellaneous debris, are washed into plastic pails of collection site sediment and returned promptly to the laboratory.

5.3 Laboratory Handling: Pails containing the amphipods are placed in a laboratory water bath or controlled temperature room for temperature control and supplied with gentle aeration. As soon as possible after collection, the amphipods are sieved from the pails of sediment and are removed from the holding vessel using a fine mesh aquarium dip net and placed into Pyrex glass sorting trays. The test organisms are picked from the detritus using a large bore eye dropper and 100 amphipods each are placed into small plastic freezer containers (9 cm x 9 cm x 6 cm) holding a 1 cm layer of clean sediment from the collection area. Freezer containers are immersed in a seawater tray provided with seawater and aeration, and held under constant illumination for at least 2 days, but no longer than 10 days prior to the beginning of the test. It may be necessary to acclimate the amphipods to the test salinity, depending upon the collection site salinity and the test water salinity. Although moderate rates of salinity change are preferred, this species is tolerant of rapid salinity changes (DeWitt, et al., 1989).

5.4 Age at Study Initiation: Adult

#### 6. DESCRIPTION OF TEST SYSTEM

6.1 Test Chambers and Environmental Control: Test chambers used in the toxicity test are 1000 ml glass beakers. The beakers are covered to minimize contamination and evaporation of seawater or loss of volatile compounds. Test chambers are maintained at constant temperature by partial immersion in a temperature-controlled water bath or by placement in a temperature-controlled room. Minimal aeration (approx. 100 bubbles/min.) is supplied through a glass pipet with the tip placed at least 2 cm above the sediment surface. The test is performed under continuous illumination, using ambient laboratory lighting. SMS may require UV light for PAH-contaminated intertidal sediments.

6.2 Cleaning: All laboratory glassware, including test chambers, is cleaned as described in EPA/600/4-90/027F. New glassware and test systems are soaked 15 minutes in tap water and scrubbed with detergent (or cleaned in an automatic dishwasher); rinsed twice with tap water; carefully rinsed once with fresh, dilute (10%, V:V) hydrochloric or nitric acid to remove scale, metals, and bases; rinsed twice with deionized water; rinsed once with acetone to remove organic compounds (using a fume hood or canopy); and rinsed three times more with deionized water. Test systems and chambers are rinsed again with dilution water just before use.

#### 7. EXPERIMENTAL DESIGN AND TEST PROCEDURES

7.1 Experimental Design: An experimental design is used consisting of exposure of test organisms to a number of test sediments, one or more reference sediments, and to the collection site control sediment. Each treatment consists of five replicate test chambers each containing 20 animals. An additional replicate containing 20 test organisms is used for daily water quality measurements. More replicates, with or without

test organisms as appropriate, may be employed for periodic interstitial water quality measurements. Blind, random testing is used.

- 7.2 Preparation of Test Sediments: The interstitial salinity of the test, reference, and control sediments is measured. Adjustment of interstitial salinities is not recommended for *Eohaustorius estuarius* under standard guidelines, as *E. estuarius* tolerates a broad salinity range and any adjustments disturb the test sediments. However, if client project specifications require interstitial salinity adjustment, the PSEP (1995) procedure described for *Rhepoxynius abronius* and *Neanthes arenaceodentata* testing may be used.

Certain projects may require purging of excess ammonia from sediment interstitial water. PSDDA and SMS allow purging to be considered when interstitial total ammonia concentrations are 60 mg/L or above (at pH = 7.7; un-ionized >0.8 mg/L). However, purging is allowed only by agency permission, so the decision to purge should be made by the client. Testing of purged sediments may require concurrent testing of the same sediments unpurged.

If no salinity adjustment or purging is done, sediments are used without further treatment. Each test sediment is mixed thoroughly using a non-contaminating implement, then an aliquot (175 ml) sufficient to make a 2-cm-deep layer is added to each test beaker, and the surface is smoothed. Bubbles are removed from the sediment by gently tapping each beaker against the palm of the hand. Seawater at the test temperature and salinity is carefully added into the beaker to the 750 ml mark utilizing a water dispersal technique to avoid suspending the sediment. The beakers are then placed into the water bath or constant-temperature room and covered with watchglasses. An air delivery pipet is inserted into each beaker under the watchglass. Overhead lights provide constant illumination. Water in the test beakers is aerated without disturbing the sediments. The test system is then allowed to temperature equilibrate overnight.

- 7.3 Beginning the Test: Amphipods are wet sieved, using a 1.0 mm sieve, from the holding sediment and impartially distributed to a series of seawater-filled containers each holding 10 amphipods. Two containers of 10 animals each are randomly added to each replicate. Once amphipods are added to a replicate, the number of animals that do not burrow into the test sediment within 15 minutes is recorded. Amphipods not burrowed are removed and replaced with healthy amphipods, unless they are actively swimming or burrowing and re-emerging, as this may be a response to toxic material. Following addition of amphipods to the test chambers, additional water is added to achieve a final volume of 950 ml.
- 7.4 Effects Criteria: Effects criteria are 1) survival after 10 days, 2) daily emergence of amphipods from the test sediments, and 3) failure of amphipods to rebury in sediment at the end of the exposure period. Death is defined as no visible appendage movement or response to tactile stimulation.
- 7.5 Test Conditions: Test containers are maintained at a constant  $15 \pm 1^\circ\text{C}$ . The selected test salinity is kept within  $\pm 1$  ppt. Frequently, a test salinity of 28 ppt is used to be consistent with *Rhepoxynius* and *Ampelisca* tests. The dissolved oxygen concentration in each test container must be greater than 60% saturation throughout the 10-day test. Each beaker is supplied with oil-free compressed air provided at a rate of approximately 100 bubbles per minute through disposable glass pipettes positioned with their tips at least 2 cm above the sediment surface. Each beaker is covered by a watchglass to minimize evaporation and the possibility of cross contamination between beakers. The test is conducted under constant illumination.
- 7.6 Feeding: Animals are not fed at any time before or during the test.
- 7.7 Test Duration, Type and Frequency of Observations, and Methods: The duration of the sediment toxicity test is 10 days. The type and frequency of observations to be made are summarized as follows:

TYPE OF OBSERVATION	TIMES OF OBSERVATION
<b>Biological Data</b>	
Emergence from sediment	daily
Survival	end of test
Reburial	end of test
<b>Physical and Chemical Data</b>	
Sediment interstitial salinity	at test beginning (bulk sediments) & end
Salinity, dissolved oxygen, pH, & temperature of overlying water (1 replicate only)	daily
Ammonia and sulfides in overlying water (1 replicate)	at test beginning & end
Ammonia, sulfide, pH, & salinity in interstitial water (optional)	for PSDDA and SMS, ammonia, pH, & salinity in bulk sediments and at test beginning and end; sulfide as requested by client
Check air and lights	daily

The presence of amphipods that have emerged from the sediments is recorded daily. Any other unusual observations are recorded. No amphipods are removed at any time until the termination of the test. The bioassay is terminated after 10 days of sediment exposure. The sediment is wet sieved through a 0.5 mm screen to recover buried amphipods. The number of surviving amphipods is recorded. For the reburial endpoint, surviving amphipods from each beaker are transferred to containers with a layer of control sediment and observed under constant illumination. The numbers of amphipods able to bury within a 1-hour exposure period are then recorded.

Dissolved oxygen is measured directly in test beakers using an air-calibrated polarographic oxygen probe. The pH is measured using a properly calibrated pH meter with scale divisions of 0.1 pH units. Temperature is measured using a calibrated mercury thermometer or a telethermometer. Salinity is measured using a refractometer. The method used for the measurement of total ammonia-N in the overlying water and sediment porewater from sediment bioassays is based on the salicylate colorimetric method of Hach Chemical Co. and was adapted from Clin. Chim. Acta., 14: 403 (1966). The method used for the measurement of dissolved sulfide in the overlying water and sediment porewater in marine sediment bioassays is the methylene blue colorimetric method based on SM 4500-S<sup>2-</sup> (Standard Methods 1995 (19<sup>th</sup> edition). Any observed changes in sediment color or the formation of a sediment discontinuity layer is also recorded.

7.8 Criteria of Test Acceptance: For the test to be considered acceptable, the minimum mean survival of organisms in the control treatment at the end of the test must be 90%, and survival in each control replicate must be at least 80%.

7.9 Performance Criterion: For PSDDA, mean percent mortality in the reference sediments must be  $\leq 20\%$  over the negative control. For SMS, mean percent mortality in the reference sediments must be  $< 25\%$ .

7.10 Reference Toxicant Test: A routine reference toxicant test is run concurrently with each sediment test. This may be a 48-hr test with sodium dodecyl sulfate (preferred), or a 96-hr test with cadmium chloride (frequently required by client). PSDDA and SMS also require a water-only ammonia test when any test sediment interstitial ammonia is  $> 30$  mg/L total ammonia (at pH=7.7; un-ionized  $> 0.4$  mg/L).

## 8. DATA ANALYSIS

The mean and standard deviation are calculated for each endpoint employed (e.g. mortality) and for each treatment (i.e. test sediment). Between-treatment comparisons may be made using a t-test (Student's t-test, approximate t-test, one-sample t-test), Wilcoxon Two-Sample test, Mann-Whitney test, or Rankit Analysis, where each treatment is compared to the control or the reference sediment. An arcsine-square root transformation of proportional data, and tests for normality and heterogeneity of variances, are performed prior to statistical comparisons. An estimate of

total effective mortality (optional) may also be calculated by summing percent mortality and percent failure to rebury.

9. REPORTING

A report of the test results must include the following information: name and identification of the test; the investigator and laboratory; sediment holding temperature data; information on the test sediment including the interstitial salinity for control, reference and test sediments; information on the source of seawater used; detailed information about the test organisms including acclimation conditions; a description of the experimental design and test chambers and other test conditions including water quality; information about any aeration that may have been required; definition of the effects criteria and other observations; unusual responses, if any, in the control treatment; daily emergence for each beaker and the 10-day mean and S.D. for each treatment; 10-day mortality for each beaker and the mean and S.D. for each treatment; failure to rebury and total effective mortality (optional) in each beaker and the mean and S.D. for each treatment; 96-hr LC50 with reference toxicant; a description of data analysis methods employed and documentation of statistical test results; any unusual information about the test or deviations from procedures.

10. STUDY DESIGN ALTERATION

Amendments made to the protocol must be approved by the sponsor and study director and should include a description of the change, the reason for the change, the date the change took effect, and the dated signatures of the study director and sponsor. Any deviations in the protocol must be described and recorded in the study raw data.

11. REFERENCES FOR PROCEDURES

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12. APPROVALS

		for	
Name	Date		
		for NORTHWESTERN AQUATIC SCIENCES	
Name	Date		



## APPENDIX II

### RAW DATA

**TEST DESCRIPTION, MONITORING, AND RESULTS  
BENCHSHEETS**

NORTHWESTERN AQUATIC SCIENCES  
MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

PROTOCOL NO. NAS-XXX-EE4

Test No. 738-1 Client Kennedy/Jenks

Investigator reviewed p. 1-63 mlf  
6-13-06

**STUDY MANAGEMENT**

Client: Kennedy/Jenks Consultants, 200 S.W. Market St., Suite 500, Portland, OR 97201

Client's Study Monitor: Dr. Taku Fuji

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir. M.S. Redmond *MLR*

QA Officer L.K. Nemeth

- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| 1. <u>Bill Montgomery</u> <i>now</i> | 2. <u>G.J. IRISSARRI</u> <i>681</i> |
| 3. <u>Susan Gahr</u> <i>AG</i>       | 4. <u>AB</u> <i>WV</i>              |
| 5. <u>R.S. Caldwell</u> <i>( )</i>   | 6. <u>Greg Hutchinson</u> <i>GH</i> |
| 7. _____                             | 8. _____                            |

Study Schedule:

Test Beginning: 2-17-06 11:30

Test Ending: 2-27-06 11:00

**TEST MATERIAL**

General description (see sample logbook/chain-of-custody for details):

NAS Sample No.:	<u>0421G</u>	<u>0422G</u>	<u>0423G</u>	<u>0424G</u>	<u>0425G</u>
Description:	<u>SD-100</u>	<u>SD-101</u>	<u>SD-102</u>	<u>SD-103</u>	<u>SD-104</u>
Collection Date:	<u>1/26/06</u>	<u>1/26/06</u>	<u>1/26/06</u>	<u>1/26/06</u>	<u>1/26/06</u>
Receipt Date:	<u>1/27/06</u>	<u>1/27/06</u>	<u>1/27/06</u>	<u>1/27/06</u>	<u>1/27/06</u>
Inters.Salinity (ppt):	<u>1.5</u>	<u>3.0</u>	<u>1.0</u>	<u>4.5</u>	<u>5.0</u>

NAS Sample No.:	<u>0426G</u>	<u>0427G</u>			
Description:	<u>REF-EBB</u>	<u>REF-YB</u>			
Collection Date:	<u>1/26/06</u>	<u>1/26/06</u>			
Receipt Date:	<u>1/27/06</u>	<u>1/27/06</u>			
Inters.Salinity (ppt):	<u>5.0</u>	<u>7.0</u>			

NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
Inters.Salinity (ppt):					

NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
Inters.Salinity (ppt):					

Error codes: 1) correction of handwriting error

2) written in wrong location; entry deleted

3) wrong date deleted, replaced with correct date

4) error found in measurement; measurement repeated Page 1 of 63

## SEDIMENT DESCRIPTIONS – SUPPLEMENTAL NOTES

Page 2 of 63

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator \_\_\_\_\_

## TEST ORGANISMS

Species: Eohaustorius estuarius Date Collected: 2-14-06  
Source: Yaquina Bay, Oregon

Field conditions when collected:

Interstitial temperature: 6.0°C Interstitial salinity: 18.0‰

## Acclimation Data:

Date	Temp. (deg.C)	pH	Sal (ppt)	DO (mg/L)	Feeding		Water changes	Comments
					amount	description		
2-14-06	12.6	7.8	23.5	9.2			yes	
2-15-06	14.0	7.9	28.5	8.6			yes	
2-16-06	13.9	7.8	29.0	8.7				
2-17-06	14.1	8.0	29.0	8.7				
Mean	13.6	7.9	27.5	8.8				
S.D.	0.7	0.1	2.7	0.3				
(N)	4	4	4	4				

Photoperiod during acclimation: constant light

## TEST PROCEDURES AND CONDITIONS

Test chambers: 1 L glass beakers covered with watchglasses

Test volumes: 175 ml of test sediment; 950 ml total volume

Replicates/treatment: (5) 5 Organisms/treatment: (100) 100

Additional replicates included for water quality purposes (indicate numbers of each that apply):

\_\_\_\_\_ Ammonia-purging sacrificial beakers (no test organisms)

\_\_\_\_\_ 1 Day zero sacrificial beaker (no test organisms)

\_\_\_\_\_ 1 Day 10 sacrificial beaker (also water quality beaker; with test organisms)

\_\_\_\_\_ Day \_\_\_\_\_ sacrificial beaker(s) (with test organisms)

Test water changes: None

Feeding: None

Beaker placement: Total randomization

Aeration: Yes, at least 2 cm above the sediment surface

Photoperiod: Constant light

Test temperature (deg.C): 15.0 +/- 1.0Salinity (ppt): 28.0 +/- 1.0

## MISCELLANEOUS NOTES

Light intensity measurements:

Date	Location in room	foot-candles
2-21-06	beaker #14	121
	#43	103

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator \_\_\_\_\_

Control Sediment:Source: Yaquina Bay, OregonDate collected: 2-14-06Interstitial salinity: 5.0900Sieved through 0.5 -mm screenStorage: 4 degrees C in the darkNAS# 0438G

Test conducted in (circle one): room 1 room 2 trailer water bath other: room #4

Randomization chart: wall

3	7	10	13	16	19	22	25	28	33
2	6	9	12	15	18	21	24	27	31
1	5	8	11	14	17	20	23	26	29

Randomization chart:

37	41	45	48	52	56				
35	39	43	47	51	55				
34	38	42	46	49	54				

Randomization chart:


Randomization chart:


**TEST WATER**Source: Yaquina Bay, Oregon, sea waterDate of Collection: 2-15-06

Salinity (ppt)

28.0

pH

Treatments: filtered to 0.4  $\mu$ m, salinity-adjusted with MilliQ deionized water, aerated

Test No. 738-1 Client Kennedy/Jenks Investigator

DAILY RECORD SHEET

Day 0 (2/17/06) wny/mjr overlying NH3 sampled (days 0,10)? yes  
overlying S sampled (days 0,10)? yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					1	ALL OK	
2					0		
* 3	14.8	7.9	26.5	8.5	8		
4							
* 5	14.9	7.8	26.5	8.5	1		
6					2		
* 7	14.9	7.8	26.5	8.4	0		
8					2		
* 9	14.9	7.6	26.5	8.6	0		
10					0		
11					0		
12					1		
13					1		
14					2		
15					1		
16					0		
17					2		
18					0		
19					1		
20					0		
21					0		
22					5		
23					1		
24					0		
25					4		
26					0		
* 27	14.9	7.7	26.0	8.3	1		
28					1		
29					4		
30							
31					0		
32							
33					2		
34					2		
35					0		
36							
37					1		
* 38	14.9	7.7	25.0	8.0	3		
39					0		
40						✓	

\* Water Quality Beakers

day zero beakers


\*\* for day zero only, this is number not buried within 10-15 minutes

Test No. 738-1 Client Kennedy/Jenks Investigator \_\_\_\_\_

## DAILY RECORD SHEET

Day 0 (2 17 66) W / msf

[illegible]

\* Water Quality Beakers  day zero beakers

\*\* for day zero only, this is number not buried within 10-15 minutes



## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator 

## DAILY RECORD SHEET

Day 2 / 18 / 06 632

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					1	ALL	
2					0	OK	
* 3	14.9	7.7	27.0	8.0	19		
4							
* 5	15.3	7.0	26.5	8.0	4		
6					20		
* 7	15.1	7.9	27.0	8.2	0		
8					0		
* 9	15.1	7.9	26.5	8.1	0		
10					0		
11					1		
12					0		
13					8		
14					16		
15					2		
16					0		
17					0		
18					4		
19					1		
20					0		
21					0		
22					18		
23					17		
24					0		
25					19		
26					0		
* 27	15.3	7.6	26.0	7.8	0		
28					16		
29					17		
30							
31					3		
32							
33					0		
34					20		
35					0		
36							
37					0		
* 38	15.5	7.7	25.0	7.8	19		
39					1		
40							

\* Water Quality Beakers

day zero beakers

Test No. 738-1

Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 1 (2/18/06) 651

[illegible]

\* Water Quality Beakers

day zero beakers

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator 

## DAILY RECORD SHEET

Day 2 (2/19/06) 632

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0	ALL	
2					0	OK	
* 3	14.8	7.8	26.5	8.3	15		
4							
* 5	15.1	7.8	26.0	8.3	0		
6					13		
* 7	14.9	8.0	27.0	8.3	0		
8					0		
* 9	14.8	7.9	26.0	8.1	0		
10					0		
11					5		
12					0		
13					4		
14					6		
15					1		
16					0		
17					0		
18					2		
19					0		
20					0		
21					0		
22					8		
23					13		
24					0		
25					12		
26					0		
* 27	15.1	7.8	26.0	8.0	3		
28					4		
29					19		
30							
31					3		
32							
33					2		
34					15		
35					0		
36							
37					1		
* 38	15.3	7.8	25.0	8.1	9		
39					2		
40							

\* Water Quality Beakers

day zero beakers

Test No. 738-1      Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 2 (2/19/06) 651

[illegible]

\* Water Quality Beakers

day zero beakers

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 3 (2/20/06) GH


Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					2	All ok	
2					0		
* 3	14.8	7.6	28.0	10.2	6		DO measurements for this day are incorrect; instrument was set to freshwater instead of 28ppt.
4							
* 5	14.9	7.7	27.5	10.4	1		The problem was not caught in time to re-measure.
6					5		
* 7	14.8	7.9	28.0	10.6	0		
8					0		
* 9	14.8	7.8	28.0	10.6	0		
10					0		
11					3		
12					0		
13					1		
14					0		
15					0		
16					0		
17					0		
18					2		
19					0		
20					0		
21					0		
22					5		
23					0		
24					0		
25					7		
26					0		
* 27	14.9	7.6	26.0	10.0	2		
28					2		
29					11		
30							
31					0		
32							
33					0		
34					5		
35					0		
36							
37					2		
* 38	15.0	7.6	26.0	10.2	5		
39					0		
40							

\* Water Quality Beakers

day zero beakers

Test No. 738-1 Client Kennedy/Jenks Investigator \_\_\_\_\_

Day 3 (2 1201a) GH

[illegible] day zero beakers

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator 

## DAILY RECORD SHEET

Day 4 (3/21/06) noon/6H

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0	All ok	
2					0		
* 3	15.3	7.6	28.0	9.4	4		DO measurements for this day are incorrect; instrument was set for freshwater rather than 28ppt. The problem was not caught in time to re-measure.
4							
* 5	15.2	7.7	28.5	9.4	0		
6					3		
* 7	15.5	7.8	28.0	9.4	0		
8					0		
* 9	15.2	7.8	28.0	9.2	0		msk
10					0		3-31-06
11					1		
12					3		
13					1		
14					0		
15					0		
16					0		
17					1		
18					5		
19					1		
20					0		
21					0		
22					2		
23					10		
24					0		
25					8		
26					0		
* 27	15.4	7.7	27.0	9.2	0		
28					1		
29					5		
30							
31					1		
32							
33					0		
34					6		
35					0		
36							
37		0.5-1.0			0	0.6H 2-21-06	
* 38	15.8	7.86	25.0	8.8	5		
39					0		
40							

\* Water Quality Beakers

day zero beakers

Test No. 738-1	Client	Kennedy/Jenks	Investigator
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## DAILY RECORD SHEET

Day 4 (2/2/06) GH/water

[illegible]

\* Water Quality Beakers

 day zero beakers



## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator 

## DAILY RECORD SHEET

Day 5 (2/22/06) W

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0		
2					0		
* 3	16.0	7.6	29.0	8.0	6		
4							
* 5	16.0	7.7	29.0	8.0	0		
6					3		
* 7	16.0	7.9	29.0	8.0	0		
8					0		
* 9	16.0	7.9	29.0	8.2	0		
10					0		
11					0		
12					0		
13					7		
14					8		
15					0		
16					0		
17					0		
18					3		
19					0		
20					0		
21					0		
22					10		
23					10		
24					0		
25					5		
26					0		
* 27	16.0	7.8	27.0	8.0	1		
28					5		
29					8		
30							
31					1		
32							
33					0		
34					6		
35					0		
36							
37					0		
* 38	16.2	7.8	26.0	7.8	4		
39					0		
40							

\* Water Quality Beakers

day zero beakers

Investigator \_\_\_\_\_

## DAILY RECORD SHEET

Day 5 (2/22/06) *con*

[illegible]

\* Water Quality Beakers

day zero beakers

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator 

## DAILY RECORD SHEET

Day 6 (2/23/06) AJ


Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0	OK	
2					0		
* 3	15.9	7.6	29.0	7.7	7		
4							
* 5	16.0	7.8	29.5	7.7	0		
6					2		
* 7	15.9	8.0	30.5	7.8	0		
8					0		
* 9	15.7	7.9	30.0	7.8	0		
10					0		
11					0		
12					0		
13					0		
14					0		
15					0		
16					0		
17					0		
18					0		
19					3		
20					0		
21					0		
22					10		
23					10		
24					0		
25					6		
26					0		
* 27	16.0	7.9	29.0	7.8	0		
28					8		
29					7		
30							
31					1		
32							
33					0		
34					8		
35					0		
36							
37					1		
* 38	16.0	7.7	26.0	7.6	4		
39					1		
40							

\* Water Quality Beakers

day zero beakers

DAILY RECORD SHEET

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					10	OK	
42					8		
* 43	16.3	7.7	26.0	7.4	8		
44							
* 45	16.2	8.0	27.0	7.8	1		
46					10		
47					9		
48					5		
49					10		
50							
51					0		
52					1		
53							
54					0		
55					8		
56					0		

 day zero beakers

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator 

## DAILY RECORD SHEET

Day 7 (2/24/66) W

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0	all ok	
2					0		
* 3	15.4	7.7	30.0	7.8	7		
4							
* 5	15.6	7.8	30.0	7.9	0		
6					2		
* 7	15.6	8.0	30.0	7.8	0		
8					0		
* 9	15.7	8.0	30.0	7.8	0		
10					0		
11					0		
12					0		
13					0		
14					8		
15					0		
16					0		
17					6		
18					0		
19					0		
20					0		
21					0		
22					10		
23					11		
24					0		
25					5		
26					0		
* 27	15.7	8.0	29.0	8.0	2		
28					7		
29					9		
30							
31					0		
32							
33					0		
34					7		
35					0		
36							
37					0		
* 38	16.0	7.7	29.5	7.6	4		
39					0		
40							

\* Water Quality Beakers

day zero beakers

Client

Kennedy/Jenks


Investigator

## DAILY RECORD SHEET

Day 7 (2 24 06) Wm

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					5	OK	
42					0		
* 43	16.0	7.7	27.0	27.0 7.4	8		
44							
* 45	16.0	8.0	29.0	7.9	0		
46					7		
47					7		
48					7		
49					7		
50							
51					0		
52					0		
53							
54					0		
55					6		
56					0		

\* Water Quality Beakers

 day zero beakers

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 8 (2 PM 106) 13

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0	AVUM	
2					0		
* 3	15.2	7.6	30.0	7.2	8		
4							
* 5	15.4	7.8	30.5	7.8	2		
6					2		
* 7	15.4	8.0	30.0	7.6	0		
8					0		
* 9	15.4	8.0	30.0	7.9	0		
10					0		
11					0		
12					0		
13					0		
14					11		
15					3		
16					0		
17					0		
18					0		
19					0		
20					0		
21					0		
22					11		
23					12		
24					0		
25					7		
26					0		
* 27	15.5	8.0	29.0	7.9	3		
28					7		
29					9		
30							
31					1		
32							
33					0		
34					7		
35					0		
36							
37					0		
* 38	15.6	7.8	28.0	7.7	5		
39					0		
40							

\* Water Quality Beakers

day zero beakers


Test No. 738-1	Client	Kennedy/Jenks	Investigator
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## DAILY RECORD SHEET

Day 8 (2/25/00) 

[illegible]

\* Water Quality Beakers

 day zero beakers



## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1

Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 9 (2/26/03)

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					1	ALL OK	
2					0		
* 3	15.4	7.7	30.0	7.6	7		
4							
* 5	15.5	7.9	30.5	7.6	4		
6					2		
* 7	15.5	8.0	30.5	7.7	0		
8					0		
* 9	15.5	8.1	30.5	7.8	0		
10					0		
11					0		
12					0		
13					0		
14					10		
15					4		
16					0		
17					1		
18					0		
19					0		
20					0		
21					0		
22					12		
23					11		
24					0		
25					8		
26					0		
* 27	15.6	8.1	29.5	7.8	4		
28					6		
29					10		
30							
31					2		
32							
33					0		
34					8		
35					0		
36							
37					0		
* 38	15.6	7.9	29.0	7.9	5		
39					0		
40							

\* Water Quality Beakers

day zero beakers

Test No. 738-1 Client Kennedy/Jenks Investigator \_\_\_\_\_

## DAILY RECORD SHEET

Day 9 (~~226~~ 106) VB

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					6	✓	
42					0		
* 43	15.8	7.7	28.0	7.7	10		
44							
* 45	15.9	8.1	30.0	7.8	0		
46					8		
47					8		
48					0		
49					6		
50							
51					0		
52					0		
53							
54					0		
55					8		
56					0	✓	

\* Water Quality Beakers

day zero beakers

## MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator 

## DAILY RECORD SHEET

Day 10 (2/27/06) GHoverlying NH<sub>3</sub> sampled (days 0,10)? yesoverlying S sampled (days 0,10)? yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					1	All 04	
2				<u>GH</u>	0		
* 3	14.9	7.7	30.0	<u>9.7 8.0</u>	1		
4							
* 5	14.6	8.1	29.5	<u>9.6 8.0</u>	1		
6				<u>GH</u>	3		
* 7	14.8	7.9	31.0	<u>10.0 8.1</u>	0		
8				<u>GH</u>	2		
* 9	14.7	8.1	30.0	<u>9.8 8.2</u>	1		
10				<u>GH</u>	0		
11				<u>2-27-06</u>	0		
12					0		
13					5		
14					4		
15					1		
16					0		
17					2		
18					0		
19					0		
20					0		
21					0		
22					4		
23					12		
24					0		
25					5		
26					0		
* 27	14.8	8.1	28.0	8.2	0		
28					6		
29					4		
30							
31					0		
32							
33					0		
34					7		
35					0		
36							
37					2		
* 38	15.1	7.9	25.0	8.2	4		
39					0		
40							

\* Water Quality Beakers

day zero beakers

Test No. 738-1 Client Kennedy/Jenks Investigator \_\_\_\_\_

## DAILY RECORD SHEET

Day 10 (2127106)GH

[illegible]

\* Water Quality Beakers

day zero beakers

Client

Kennedy/Jenks

Investigator

## DAY 10 TEST TERMINATION SHEET

Beaker No.	No. of Survivors	Number reburied	Initial	Comment
1	11	11	MR	+1 dead
2	20	20	GH	
3				
4				
5				
6	0	0	GH	+8 dead
7				
8	18	18	MR	
9				
10	20	20	GH	
11	9	9	MR	
12	6	6	GH	+2 dead
13	8	8	WR	+9 dead
14	0	-	MR	+4 dead
15	16	16	WR	
16	7	7	GH	+4 dead
17	8	8	WR	+5 dead
18	5	5	MR	+6 dead
19	8	8	WR	+2 dead
20	14	14	GH	+1 dead
21	9	9	WR	+3 dead
22	0	-	MR	+6 dead
23	8	-	WR	+10 dead
24	19	19	GH	+1 dead
25	8	-	WR	+7 dead
26	17	17	MR	
27	16	16	WR	+1 dead
28	0	0	GH	+1 dead
29	8	-	WR	+4 dead
30				
31	17	17	WR	
32				
33	15	15	GH	
34	8	-	WR	
35	20	20	WR	
36				
37	used as a WG beaker instead of #			
38				
39	14	14	WR	
40				

[illegible]

water quality or day zero beakers

Dissolved Sulfide in Water: Computation Worksheet				
Methylene Blue Method (SOP #5550)				
<b>Standardization</b>		1	2	3
uL PAO titrant employed:		96	97	97
Working Std. Conc. (mg/L):		1.65333		
<b>Result</b>				
Sample description	Dilution factor	OD <sub>664</sub>	Sulfide (mg/L)	
Blank				
1.0 mL working sulfide std.		0.160	0.33	
2.0 mL working sulfide std.		0.350	0.66	
3.0 mL working sulfide std.		0.524	0.99	
4.0 mL working sulfide std.		0.676	1.32	
5.0 mL working sulfide std.		0.845	1.65	
3.0 mL spike		0.530	1.03	
3.0 mL spike dupl.		0.520	1.01	
1. 0421G (SD-100)	5	0.000	ND	
2. 0422G (SD-101)	5	0.002	ND	
3. 0423G (SD-102)	5	0.004	ND	
4. 0424G (SD-103)	5	0.000	ND	
5. 0425G (SD-104)	5	0.000	ND	
6. 0426G (REF-EBB)	5	0.000	ND	
7. 0427G (REF-YB)	5	0.000	ND	
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36.				

Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = 102.8

Precision (RPD) = 1.90

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: P738

Test Day: Bulk sediment

Species: NA

Sediment pore water

Analyst: RSC

Date analysed: 2/16/2006

Dissolved Sulfide in Water: Computation Worksheet			
Methylene Blue Method (SOP #5550)			
<b>Standardization</b>			
	1	2	3
μL PAO titrant employed:	96	97	97
Working Std. Conc. (mg/L):	3.2		
<b>Result</b>			
Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank			
1.0 mL working sulfide std.		160	0.64
2.0 mL working sulfide std.		350	1.28
3.0 mL working sulfide std.		524	1.92
4.0 mL working sulfide std.		676	2.56
5.0 mL working sulfide std.		875	3.20
3.0 mL spike		535	
3.0 mL spike dupl.		525	
1. 0421G (SD-100)	5	100	
2. 0422G (SD-101)	5	202	
3. 0423G (SD-102)	5	204	
4. 0424G (SD-103)	5	200	
5. 0425G (SD-104)	5	260	
6. 0426G (REF-EBB)	5	200	
7. 0427G (REF-YB)	5	200	
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36.			

Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: P738

Test Day: Bulk sediment

Species: NA

Sediment pore water

Analyst: RSC

Date analysed: 2/16/2006

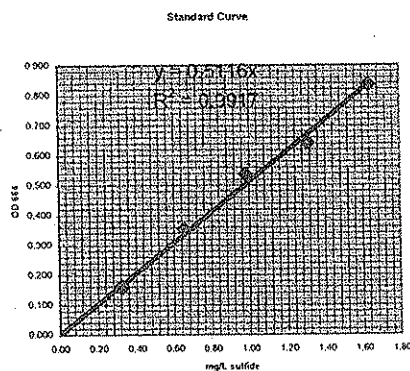
### Dissolved Sulfide in Water: Computation Worksheet Methylene Blue Method (SOP #5550)

**Standardization**

	1	2	3
uL PAO titrant employed:	98	99	96
Working Std. Conc. (mg/L):	1.63733		

**Result**

Sample description	Dilution factor	OD <sub>664</sub>	Sulfide (mg/L)
Blank	---	---	---
1.0 mL working sulfide std.	---	0.160	0.33
2.0 mL working sulfide std.	---	0.352	0.65
3.0 mL working sulfide std.	---	0.536	0.98
4.0 mL working sulfide std.	---	0.642	1.31
5.0 mL working sulfide std.	---	0.835	1.64
3.0 mL spike	---	0.525	1.02
3.0 mL spike dupl.	---	0.532	1.04



1.	3	5	0.000	ND
2.	5	5	0.000	ND
3.	7	5	0.002	ND
4.	9	5	0.000	ND
5.	27	5	0.004	ND
6.	38	5	0.000	ND
7.	43	5	0.000	ND
8.	45	5	0.000	ND

Reporting limit (mg/L) = 0.1

Recovery (%) = 105.0

Precision (RPD) = -1.32

Sample volume (ml): 1.00

Dilution factor 5

**Sample Set Description:**

Test No.: 738-1

Test Day: 0 (2-17-06)

Species: *Eohaustorius*

overlying water

Analyst: RSC

Date analysed: 2/17/2006



Dissolved Sulfide in Water: Computation Worksheet				
Methylene Blue Method (SOP #5550)				
<b>Standardization</b>		1	2	3
uL PAO titrant employed:		98	99	96
Working Std. Conc. (mg/L):		3.2		
<b>Result</b>				
Sample description	Dilution factor	OD664	Sulfide (mg/L)	
Blank	---	---	---	
1.0 mL working sulfide std.	---	.160	0.64	
2.0 mL working sulfide std.	---	.352	1.28	
3.0 mL working sulfide std.	---	.536	1.92	
4.0 mL working sulfide std.	---	.642	2.56	
5.0 mL working sulfide std.	---	.835	3.20	
3.0 mL spike	---	.525		
3.0 mL spike dupl.	---	.532		
1. 3	5	.000		
2. 5	5	.000		
3. 7	5	.002		
4. 9	5	.000		
5. 27	5	.004		
6. 38	5	.005		
7. 43	5	.000		
8. 45	5	.000		
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Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: 738-1

Test Day: 0 (2-17-06)

Species: Eohaustorius

overlying water

Analyst: RSC

Date analysed: 2/17/2006

Dissolved Sulfide in Water: Computation Worksheet				
Methylene Blue Method (SOP #5550)				
<b>Standardization</b>		1	2	3
μL PAO titrant employed:		99	97	98
Working Std. Conc. (mg/L):		1.632		
<b>Result</b>				
Sample description	Dilution factor	OD <sub>664</sub>	Sulfide (mg/L)	
Blank	----	----	----	
1.0 mL working sulfide std.	----	0.165	0.33	
2.0 mL working sulfide std.	----	0.345	0.65	
3.0 mL working sulfide std.	----	0.532	0.98	
4.0 mL working sulfide std.	----	0.653	1.31	
5.0 mL working sulfide std.	----	0.835	1.63	
3.0 mL spike	----	0.525	1.02	
3.0 mL spike dupl.	----	0.518	1.01	
1.	3	5	0.000	ND
2.	5	5	0.000	ND
3.	7	5	0.002	ND
4.	9	5	0.003	ND
5.	37	5	0.000	ND
6.	38	5	0.002	ND
7.	43	5	0.004	ND
8.	45	5	0.001	ND
9.				
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Standard Curve

Standard Curve Data:

mg/L sulfide	OD 664
0.00	0.000
0.20	0.103
0.40	0.206
0.60	0.309
0.80	0.412
1.00	0.515
1.20	0.618
1.40	0.721
1.60	0.824
1.80	0.927

Reporting limit (mg/L) = 0.1

Recovery (%) = 103.4

Precision (RPD) = 1.34

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: 738-1

Test Day: 10 (2-27-06)

Species: *Eohaustorius*

overlying water

Analyst: RSC

Date analysed: 2/27/2006

Dissolved Sulfide in Water: Computation Worksheet			
Methylene Blue Method (SOP #5550)			
<b>Standardization</b>		1	2
uL PAO titrant employed:		49	47
Working Std. Conc. (mg/L):		3.2	
<b>Result</b>			
Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank			
1.0 mL working sulfide std.		.163	0.64
2.0 mL working sulfide std.		.345	1.28
3.0 mL working sulfide std.		.532	1.92
4.0 mL working sulfide std.		.659	2.56
5.0 mL working sulfide std.		.835	3.20
3.0 mL spike		.565	
3.0 mL spike dupl.		.518	
1.	3	5	.000
2.	5	5	.000
3.	7	5	.002
4.	9	5	.003
5.	37	5	.003
6.	38	5	.002
7.	43	5	.004
8.	45	5	.001
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36.			

Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: 738-1

Test Day: 10 (2-27-06)

Species: *Eohaustorius*

overlying water

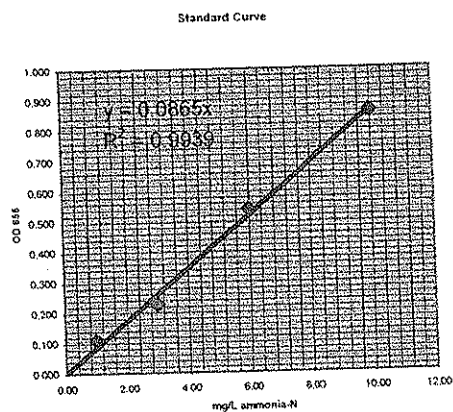
Analyst: RSC

Date analysed: 2/27/2006

# **Total Ammonia-N in Sediment Pore Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)	pH	Salinity (ppt)
Blank					
1.0 mg/L NH <sub>3</sub> -N Std.		0.110	1.00		
3.0 mg/L NH <sub>3</sub> -N Std.		0.227	3.00		
6.0 mg/L NH <sub>3</sub> -N Std.		0.540	6.00		
10.0 mg/L NH <sub>3</sub> -N Std.		0.860	10.00		
3.0 mg/L spike		0.215	2.48		
3.0 mg/L spike dupl.		0.213	2.46		
5.0 mg/L 2nd source		0.360	4.15		
1. 0421G (SD-100)	5	0.106	6.11		
2. 0422G (SD-101)	5	0.228	13.15		
3. 0423G (SD-102)	5	0.052	3.00		
4. 0424G (SD-103)	5	0.187	10.79		
5. 0425G (SD-104)	5	0.244	14.08		
6. 0426G (REF-EBB)	5	0.208	12.00		
7. 0427G (REF-YB)	5	0.224	12.92		
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Reporting limit (mg/L) = 0.5

Recovery (%) = 82.3

Precision (RPD) = 0.93

2nd source (%) = 83.1

Sample volume (ml): 0.10

Dilution factor 5

**Sample Set Description:**

Proj. No.: P738

Test Day: NA

Species: NA

Bulk Sediment porewaters

Analyst: RSC

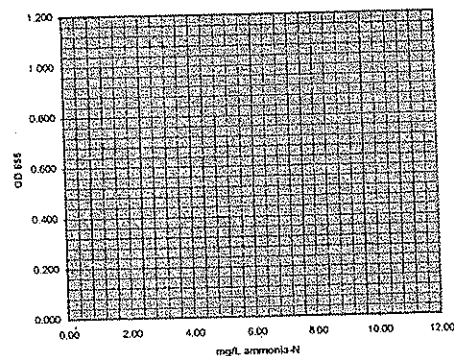
Date analysed: 2/16/2006

# **Total Ammonia-N in Sediment Pore Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)	pH	Salinity (ppt)
Blank	----	----	----	----	----
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.110	1.00		
3.0 mg/L NH <sub>3</sub> -N Std.	----	0.27	3.00		
6.0 mg/L NH <sub>3</sub> -N Std.	----	0.54	6.00		
10.0 mg/L NH <sub>3</sub> -N Std.	----	0.86	10.00		
3.0 mg/L spike	----	0.215			
3.0 mg/L spike dupl.	----	0.213			
5.0 mg/L 2nd source	----	0.36			
1. 0421G (SD-100)	5	0.106	6.9	1.5	
2. 0422G (SD-101)	5	0.228	7.1	3.0	
3. 0423G (SD-102)	5	0.52	7.4	1.0	
4. 0424G (SD-103)	5	0.187	7.2	4.5	
5. 0425G (SD-104)	5	0.244	7.3	5.0	
6. 0426G (REF-EBB)	5	0.205	7.2	5.0	
7. 0427G (REF-YB)	5	0.224	7.7	7.0	
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Standard Curve



Reporting limit (mg/L) = 0.5

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.10

Dilution factor 5

**Sample Set Description:**

Proj. No.: P738

Test Day: NA

Species: NA

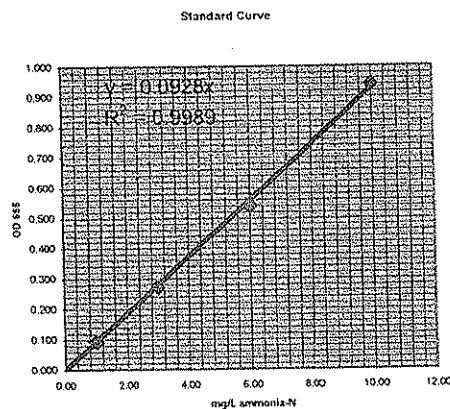
Bulk Sediment porewaters

Analyst: RSC  
Date analysed: 2/16/2006

# **Total Ammonia-N in Sediment Pore Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)	pH	Salinity (ppt)
Blank	-----	-----	-----		
1.0 mg/L NH <sub>3</sub> -N Std.	-----	0.092	1.00		
3.0 mg/L NH <sub>3</sub> -N Std.	-----	0.272	3.00		
6.0 mg/L NH <sub>3</sub> -N Std.	-----	0.540	6.00		
10.0 mg/L NH <sub>3</sub> -N Std.	-----	0.940	10.00		
3.0 mg/L spike	-----	0.278	2.99		
3.0 mg/L spike dupl.	-----	0.265	2.85		
5.0 mg/L 2nd source	-----	0.422	4.55		



1.	4	5	0.100	5.39
2.	30	5	0.318	17.13
3.	32	5	0.308	16.59
4.	36	5	0.357	19.23
5.	40	5	0.013	0.70
6.	44	5	0.325	17.51
7.	50	5	0.297	16.00
8.	53	5	0.147	7.92

Reporting limit (mg/L) = 0.5

Recovery (%) = 97.5

Precision (RPD) = 4.79

2nd source (%) = 90.9

Sample volume (ml): 0.10

Dilution factor 5

**Sample Set Description:**

Proj. No.: 738-1

Test Day: 0 (2-17-06)

Species: Eohaustorius

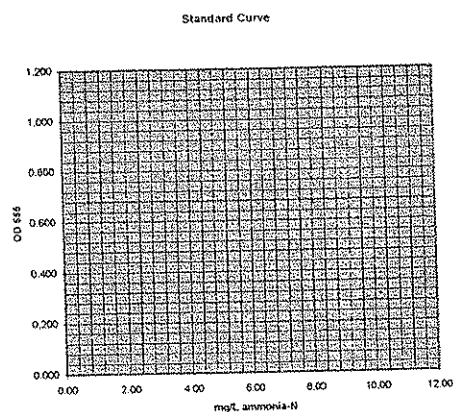
Sediment porewaters

Analyst: RSC  
 Date analysed: 2/17/2006

# **Total Ammonia-N in Sediment Pore Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD655	NH3-N (mg/L)	pH	Salinity (ppt)
Blank	---	---	---	---	---
1.0 mg/L NH3-N Std.	---	0.092	1.00	---	---
3.0 mg/L NH3-N Std.	---	0.272	3.00	---	---
6.0 mg/L NH3-N Std.	---	0.540	6.00	---	---
10.0 mg/L NH3-N Std.	---	0.940	10.00	---	---
3.0 mg/L spike	---	0.278	---	---	---
3.0 mg/L spike dupl.	---	0.20	---	---	---
5.0 mg/L 2nd source	---	0.922	---	---	---



1.	4	5	1.00	6.5	13.0
2.	30	5	3.18	6.5	14.0
3.	32	5	3.08	7.2	16.0
4.	36	5	3.57	6.6	14.0
5.	40	5	0.13	7.6	23.0
6.	44	5	3.25	6.8	15.0
7.	50	5	2.97	6.7	16.0
8.	53	5	1.47	6.6	14.0

Reporting limit (mg/L) = 0.5

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.10

Dilution factor 5

**Sample Set Description:**

Proj. No.: 738-1

Test Day: 0 (2-17-06)

Species: Eohaustorius

~~Bulk~~ Sediment porewaters

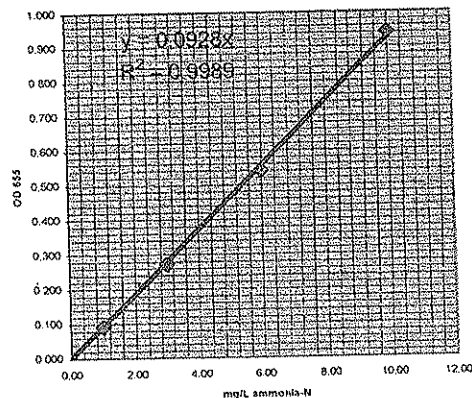
Analyst: RSC  
 Date analysed: 2/17/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	0.092	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	0.272	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	0.540	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	0.940	10.00
3.0 mg/L spike	---	0.278	2.99
3.0 mg/L spike dupl.	---	0.265	2.85
5.0 mg/L 2nd source	---	0.422	4.55
1. 3	1	0.145	1.56
2. 5	1	0.258	2.78
3. 7	1	0.017	0.18
4. 9	1	0.290	3.12
5. 27	1	0.232	2.50
6. 38	1	0.089	0.96
7. 43	1	0.258	2.78
8. 45	1	0.270	2.91
9.			
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36.			

Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = 97.5

Precision (RPD) = 4.79

2nd source (%) = 90.9

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-1

Test Day: 0 (2-17-06)

Species: Eohaustorius

Overlying water

Analyst: RSC

Date analysed: 2/17/2006

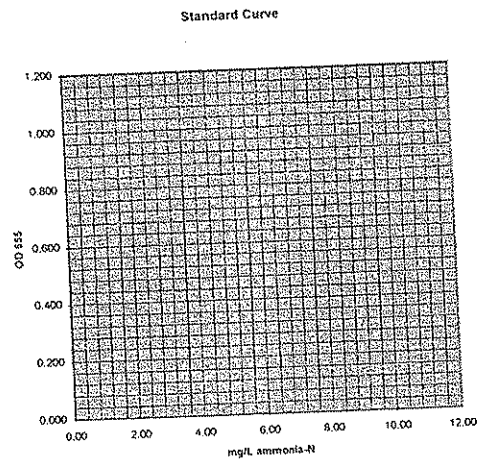


# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD655	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	0.92	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	2.72	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	5.40	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	9.40	10.00
3.0 mg/L spike	---	3.75	---
3.0 mg/L spike dupl.	---	3.65	---
5.0 mg/L 2nd source	---	4.22	---

1.	3	1	1.45
2.	5	1	2.58
3.	7	1	3.17
4.	9	1	2.90
5.	27	1	2.32
6.	38	1	2.02
7.	43	1	2.58
8.	45	1	2.70
9.			
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36.			



Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-1

Test Day: 0 (2-17-06)

Species: Eohaustorius

Overlying water

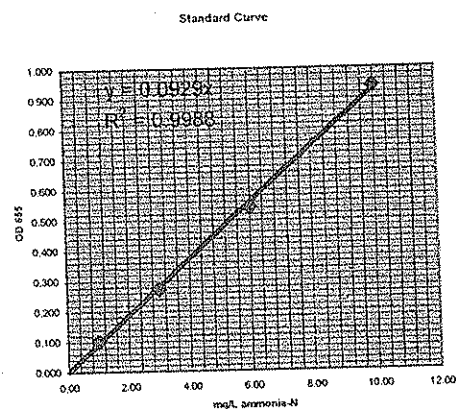
Analyst: RSC

Date analysed: 2/17/2006

# **Total Ammonia-N in Sediment Pore Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)	pH	Salinity (ppt)
Blank					
1.0 mg/L NH <sub>3</sub> -N Std.		0.102	1.00		
3.0 mg/L NH <sub>3</sub> -N Std.		0.272	3.00		
6.0 mg/L NH <sub>3</sub> -N Std.		0.542	6.00		
10.0 mg/L NH <sub>3</sub> -N Std.		0.940	10.00		
3.0 mg/L spike		0.288	3.10		
3.0 mg/L spike dupl.		0.293	3.15		
5.0 mg/L 2nd source		0.442	4.75		
1. 3 5		0.418	22.48		
2. 5 5		0.640	34.42		
3. 7 5		0.040	2.15		
4. 9 5		0.560	30.11		
5. 37 5		0.208	11.19		
6. 38 5		0.528	28.39		
7. 43 5		0.820	44.10		
8. 45 5		0.720	38.72		
9.					
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35.					
36.					



Reporting limit (mg/L) = 0.5

Recovery (%) = 104.1

Precision (RPD) = -1.72

2nd source (%) = 95.1

Sample volume (ml): 0.10

Dilution factor 5

**Sample Set Description:**

Proj. No.: 738-1

Test Day: 10 (2-27-06)

Species: Eohaustorius

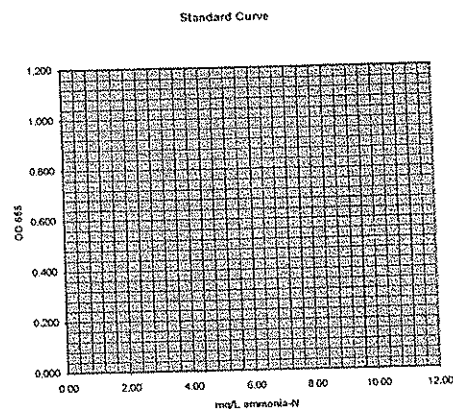
Sediment porewaters

Analyst: RSC  
Date analysed: 2/27/2006

# **Total Ammonia-N in Sediment Pore Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)	pH	Salinity (ppt)
Blank					
1.0 mg/L NH <sub>3</sub> -N Std.		1.02	1.00		
3.0 mg/L NH <sub>3</sub> -N Std.		2.72	3.00		
6.0 mg/L NH <sub>3</sub> -N Std.		5.42	6.00		
10.0 mg/L NH <sub>3</sub> -N Std.		9.40	10.00		
3.0 mg/L spike		2.88			
3.0 mg/L spike dupl.		2.93			
5.0 mg/L 2nd source		4.42			
1. 3	5	4.10	6.7	28.0	
2. 5	5	6.40	6.5	28.0	
3. 7	5	0.40	7.6	27.5	
4. 9	5	5.60	6.1	29.0	
5. 37	5	2.08	6.6	27.0	
6. 38	5	5.28	6.4	28.0	
7. 43	5	8.26	6.4	26.0	
8. 45	5	7.20	7.0	27.0	
9.					
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Reporting limit (mg/L) = 0.5

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.10

Dilution factor 5

**Sample Set Description:**

Proj. No.: 738-1

Test Day: 10 (2-27-06)

Species: Eohaustorius

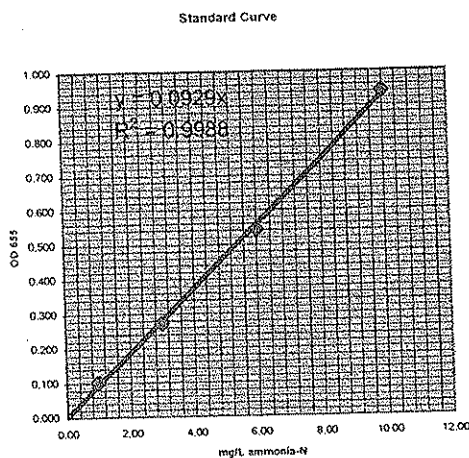
Sediment porewaters

Analyst: RSC  
Date analysed: 2/27/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank			
1.0 mg/L NH <sub>3</sub> -N Std.		0.102	1.00
3.0 mg/L NH <sub>3</sub> -N Std.		0.272	3.00
6.0 mg/L NH <sub>3</sub> -N Std.		0.542	6.00
10.0 mg/L NH <sub>3</sub> -N Std.		0.940	10.00
3.0 mg/L spike		0.288	3.10
3.0 mg/L spike dupl.		0.293	3.15
5.0 mg/L 2nd source		0.442	4.75
1. 3	1	0.157	1.69
2. 5	1	0.211	2.27
3. 7	1	0.013	0.14
4. 9	1	0.099	1.06
5. 37	1	0.162	1.74
6. 38	1	0.029	0.31
7. 43	1	0.422	4.54
8. 45	1	0.190	2.04



Reporting limit (mg/L) = 0.1

Recovery (%) = 104.1

Precision (RPD) = -1.72

2nd source (%) = 95.1

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-1

Test Day: 10 (2-27-06)

Species: Eohaustorius

Overlying water

Analyst:

RSC

Date analysed:

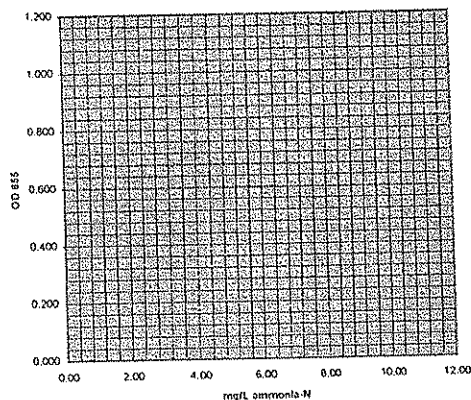
2/27/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD655	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	102	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	272	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	542	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	940	10.00
3.0 mg/L spike	---	288	
3.0 mg/L spike dupl.	---	293	
5.0 mg/L 2nd source	---	442	
1. 3	1	157	
2. 5	1	211	
3. 7	1	013	
4. 9	1	099	
5. 37	1	162	
6. 38	1	029	
7. 43	1	422	
8. 45	1	190	
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36.			

Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-1

Test Day: 10 (2-27-06)

Species: Eohaustorius

Overlying water

Analyst: RSC

Date analysed: 2/27/2006

**TEST DATA ANALYSIS RECORDS**

Marine Amphipod Test  
Randomization Key

	NAS	CLIENT		
BKR	SMPL	DESCRIP	REPL	
22	0421G	SD-100	1	
13	0421G	SD-100	2	
28	0421G	SD-100	3	
14	0421G	SD-100	4	
55	0421G	SD-100	5	
3	0421G	SD-100	6	wq repl
53	0421G	SD-100	7	day0 bkr
49	0422G	SD-101	1	
48	0422G	SD-101	2	
41	0422G	SD-101	3	
29	0422G	SD-101	4	
47	0422G	SD-101	5	
43	0422G	SD-101	6	wq repl
36	0422G	SD-101	7	day0 bkr
46	0423G	SD-102	1	
23	0423G	SD-102	2	
34	0423G	SD-102	3	
6	0423G	SD-102	4	
25	0423G	SD-102	5	
38	0423G	SD-102	6	wq repl
4	0423G	SD-102	7	day0 bkr
19	0424G	SD-103	1	
51	0424G	SD-103	2	
18	0424G	SD-103	3	
52	0424G	SD-103	4	
11	0424G	SD-103	5	
5	0424G	SD-103	6	wq repl
44	0424G	SD-103	7	day0 bkr
39	0425G	SD-104	1	
20	0425G	SD-104	2	
33	0425G	SD-104	3	
15	0425G	SD-104	4	
31	0425G	SD-104	5	
9	0425G	SD-104	6	wq repl
50	0425G	SD-104	7	day0 bkr
1	0426G	REF-EBB	1	
26	0426G	REF-EBB	2	
37	0426G	REF-EBB	3	
42	0426G	REF-EBB	4	
8	0426G	REF-EBB	5	
27	0426G	REF-EBB	6	wq repl
30	0426G	REF-EBB	7	day0 bkr
56	0427G	REF-YB	1	
17	0427G	REF-YB	2	
16	0427G	REF-YB	3	
12	0427G	REF-YB	4	
21	0427G	REF-YB	5	
45	0427G	REF-YB	6	wq repl
32	0427G	REF-YB	7	day0 bkr
35	0438G	control	1	
24		control	2	
2		control	3	
54		control	4	
10		control	5	
7		control	6	wq repl
40		control	7	day0 bkr

Data entry verified  
against Laboratory bench  
sheets - MSL 2-27-06

[illegible]



## Marine Amphipod Test

Test no. 738-1

IN-DEX	NAS-BKR	SMP	CLIENT	REPL	INIT	SURV	REBUR	MORT	NO-BURY	ITEM	PSURV	PMORT	PBURY	PNO-BURY	ITEM	PTM	SURV	MORT	NO-BURY	PSURV	PMORT	PBURY	PNO-BURY	ITEM
39	42	0426G	REF-EBB	4	20	15	15	5	0	5	75.0	25.0	100.0	0.0	25.0	n		5	5	5	5	5	5	5
40	8	0426G	REF-EBB	5	20	18	18	2	0	2	90.0	10.0	100.0	0.0	10.0									
41	27	0426G	REF-EBB	6	20	16	16	4	0	4	80.0	20.0	100.0	0.0	20.0									
42	30	0426G	REF-EBB	7	20																			
43	56	0427G	REF-YB	1	20	9	9	11	0	11	45.0	55.0	100.0	0.0	55.0	Mean	7.8	12.2	0.0	39.0	61.0	100.0	0.0	61.0
44	17	0427G	REF-YB	2	20	8	8	12	0	12	40.0	60.0	100.0	0.0	60.0	SD	1.3	1.3	0.0	6.5	6.5	0.0	0.0	6.5
45	16	0427G	REF-YB	3	20	7	7	13	0	13	35.0	65.0	100.0	0.0	65.0	n	5	5	5	5	5	5	5	5
46	12	0427G	REF-YB	4	20	6	6	14	0	14	30.0	70.0	100.0	0.0	70.0									
47	21	0427G	REF-YB	5	20	9	9	11	0	11	45.0	55.0	100.0	0.0	55.0									
48	45	0427G	REF-YB	6	20																			
49	32	0427G	REF-YB	7	20																			
50	35	0438G	control	1	20	20	20	0	0	0	100.0	0.0	100.0	0.0	0.0	Mean	19.8	0.2	0.0	99.0	1.0	100.0	0.0	1.0
51	24	0438G	control	2	20	19	19	1	0	1	95.0	5.0	100.0	0.0	5.0	SD	0.4	0.4	0.0	2.2	2.2	0.0	0.0	2.2
52	2	0438G	control	3	20	20	20	0	0	0	100.0	0.0	100.0	0.0	0.0	n	5	5	5	5	5	5	5	5
53	54	0438G	control	4	20	20	20	0	0	0	100.0	0.0	100.0	0.0	0.0									
54	10	0438G	control	5	20	20	20	0	0	0	100.0	0.0	100.0	0.0	0.0									
55	7	0438G	control	6	20																			
56	40	0438G	control	7	20																			

Project Name: P738 Eohaustorius % mortality

Sample: x1  
 Samp ID: SD-100  
 Alias: NAS #0421G  
 Replicates: 5  
 Mean: 100  
 SD: 0  
 Tr Mean: 0.739  
 Trans SD: 0

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 23  
 SD: 13.509  
 Tr Mean: -0.739  
 Trans SD: 0.554

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: Residual SD: SS: K: b:  Alpha Level: N/A Calculated Value: N/A Critical Value: N/A  Normally Distributed: N/A  Override Option: Not Invoked	Test Residual Mean: 0 Test Residual SD: 0 Ref. Residual Mean: 0.425 Ref. Residual SD: 0.285 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 3.3351 Critical Value: $\geq 1.86$  Variances Homogeneous: No	Statistic: Approximate t Balanced Design: Yes Transformation: Rankits  Experimental Hypothesis Null: $x_1 \leq x_2$ Alternate: $x_1 > x_2$  Degrees of Freedom: 4 Experimental Alpha Level: 0.05 Calculated Value: 5.9677 Critical Value: $\geq 2.132$ Accept Null Hypothesis: No  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	100	0.739	45	-0.123	0	0.616		18.435	
2	100	0.739	15	-1.001	0	0.262		22.786	
3	100	0.739	25	-0.376	0	0.363		26.565	
4	100	0.739	10	-1.539	0	0.8		30	
5	100	0.739	20	-0.656	0	0.083		42.13	
6								114.591	
7								114.591	
8								114.591	
9								114.591	
10								114.591	

Data entry verified against EXCEL spreadsheet.

%Mortality in test sediment SD-100 was significantly greater than that in reference sediment REF-EBB at  $\alpha=0.05$ .

msr  
6-5-06

Project Name: P738 Eohaustorius % mortality

Sample: x1  
 Samp ID: SD-101  
 Alias: NAS #0422G  
 Replicates: 5  
 Mean: 100  
 SD: 0  
 Tr Mean: 0.739  
 Trans SD: 0

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 23  
 SD: 13.509  
 Tr Mean: -0.739  
 Trans SD: 0.554

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: Residual SD: SS: K: b:	Test Residual Mean: 0 Test Residual SD: 0 Ref. Residual Mean: 0.425 Ref. Residual SD: 0.285 Deg. of Freedom: 8	Statistic: Approximate t Balanced Design: Yes Transformation: Rankits
Alpha Level: N/A Calculated Value: N/A Critical Value: N/A	Alpha Level: 0.1 Calculated Value: 3.3351 Critical Value: $\geq 1.86$	Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$
Normally Distributed: N/A	Variances Homogeneous: No	Degrees of Freedom: 4 Experimental Alpha Level: 0.05 Calculated Value: 5.9677 Critical Value: $\geq 2.132$ Accept Null Hypothesis: No
Override Option: Not Invoked		Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	100	0.739	45	-0.123	0	0.616		18.435	
2	100	0.739	15	-1.001	0	0.262		22.786	
3	100	0.739	25	-0.376	0	0.363		26.565	
4	100	0.739	10	-1.539	0	0.8		30	
5	100	0.739	20	-0.656	0	0.083		42.13	
6								114.591	
7								114.591	
8								114.591	
9								114.591	
10								114.591	

Data entry verified against EXCEL spreadsheet.  
 %Mortality in test sediment SD-101 was significantly greater than that in reference sediment REF-EBB at  $\alpha=0.05$ .

*MR 65-06*

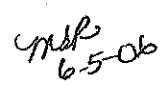
Project Name: P738 Eohaustorius % mortality

Sample: x1  
 Samp ID: SD-102  
 Alias: NAS #0423G  
 Replicates: 5  
 Mean: 100  
 SD: 0  
 Tr Mean: 0.739  
 Trans SD: 0

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 23  
 SD: 13.509  
 Tr Mean: -0.739  
 Trans SD: 0.554

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean:	Test Residual Mean: 0	Statistic: Approximate t
Residual SD:	Test Residual SD: 0	Balanced Design: Yes
SS:	Ref. Residual Mean: 0.425	Transformation: Rankits
K:	Ref. Residual SD: 0.285	Experimental Hypothesis
b:	Deg. of Freedom: 8	Null: $x_1 \leq x_2$
Alpha Level: N/A	Alpha Level: 0.1	Alternate: $x_1 > x_2$
Calculated Value: N/A	Calculated Value: 3.3351	Degrees of Freedom: 4
Critical Value: N/A	Critical Value: $\geq 1.86$	Experimental <u>Alpha Level: 0.05</u>
Normally	Variances	Calculated Value: 5.9677
Distributed: N/A	Homogeneous: No	Critical Value: $\geq 2.132$
Override Option: Not Invoked		<u>Accept Null Hypothesis: No</u>
		Power:
		Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	100	0.739	45	-0.123	0	0.616		18.435	
2	100	0.739	15	-1.001	0	0.262		22.786	
3	100	0.739	25	-0.376	0	0.363		26.565	
4	100	0.739	10	-1.539	0	0.8		30	
5	100	0.739	20	-0.656	0	0.083		42.13	
6								114.591	
7								114.591	
8								114.591	
9								114.591	
10								114.591	

Data entry verified against EXCEL spreadsheet.  
 %Mortality in test sediment SD-102 was significantly greater than that in reference sediment REF-EBB at  $\alpha=0.05$ . 

Project Name: P738 Eohaustorius % mortality

Sample: x1  
 Samp ID: SD-103  
 Alias: NAS #0424G  
 Replicates: 5  
 Mean: 61  
 SD: 8.216  
 Tr Mean: 51.455  
 Trans SD: 4.992

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 23  
 SD: 13.509  
 Tr Mean: 27.983  
 Trans SD: 9.005

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 4.724 SS: 424.065 K: 5 b: 19.705  Alpha Level: 0.05 Calculated Value: 0.9156 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 3.418 Test Residual SD: 3.212 Ref. Residual Mean: 6.465 Ref. Residual SD: 5.371 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 1.0889 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: ArcSin  Experimental Hypothesis Null: $x_1 \leq x_2$ Alternate: $x_1 > x_2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.05 Calculated Value: 5.0974 Critical Value: $\geq 1.86$ Accept Null Hypothesis: No  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	60	50.768	45	42.13	0.687	14.147			-9.548
2	55	47.869	15	22.786	3.586	5.197			-5.197
3	75	60	25	30	8.545	2.017			-3.586
4	60	50.768	10	18.435	0.687	9.548			-3.586
5	55	47.869	20	26.565	3.586	1.418			-1.418
6									-0.687
7									-0.687
8									2.017
9									8.545
10									14.147

Data entry verified against EXCEL spreadsheet.

%Mortality in test sediment SD-103 was significantly greater than that in reference sediment REF-EBB at  $\alpha=0.05$ .

*mlr*  
6-5-06

Project Name: P738 Eohaustorius % mortality

Sample: x1  
 Samp ID: SD-104  
 Alias: NAS #0425G  
 Replicates: 5  
 Mean: 24  
 SD: 6.519  
 Tr Mean: 29.155  
 Trans SD: 4.497

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 23  
 SD: 13.509  
 Tr Mean: 27.983  
 Trans SD: 9.005

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 4.618 SS: 405.276 K: 5 b: 19.665  Alpha Level: 0.05 Calculated Value: 0.9542 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 3.583 Test Residual SD: 2.042 Ref. Residual Mean: 6.465 Ref. Residual SD: 5.371 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 1.1216 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: ArcSin  Experimental Hypothesis Null: $x_1 \leq x_2$ Alternate: $x_1 > x_2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.05 Calculated Value: 0.2602 Critical Value: $\geq 1.86$ Accept Null Hypothesis: Yes  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	30	33.211	45	42.13	4.056	14.147			-9.548
2	30	33.211	15	22.786	4.056	5.197			-6.368
3	25	30	25	30	0.845	2.017			-5.197
4	20	26.565	10	18.435	2.59	9.548			-2.59
5	15	22.786	20	26.565	6.368	1.418			-1.418
6									0.845
7									2.017
8									4.056
9									4.056
10									14.147

Data entry verified against EXCEL spreadsheet.

%Mortality in test sediment SD-104 was not significantly greater than that in reference sediment REF-EBB at  $\alpha=0.05$ .

*msr*  
 6-5-06

Emergence Data File									
INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
1	22	0421G	SD-100	1	1	18			
1	22	0421G	SD-100	1	2	8			
1	22	0421G	SD-100	1	3	5			
1	22	0421G	SD-100	1	4	2			
1	22	0421G	SD-100	1	5	10			
1	22	0421G	SD-100	1	6	10			
1	22	0421G	SD-100	1	7	10			
1	22	0421G	SD-100	1	8	11			
1	22	0421G	SD-100	1	9	12			
1	22	0421G	SD-100	1	10	4	90		
2	13	0421G	SD-100	2	1	8			
2	13	0421G	SD-100	2	2	4			
2	13	0421G	SD-100	2	3	1			
2	13	0421G	SD-100	2	4	1			
2	13	0421G	SD-100	2	5	7			
2	13	0421G	SD-100	2	6	9			
2	13	0421G	SD-100	2	7	0			
2	13	0421G	SD-100	2	8	0			
2	13	0421G	SD-100	2	9	0			
2	13	0421G	SD-100	2	10	5	35		
3	28	0421G	SD-100	3	1	16			
3	28	0421G	SD-100	3	2	4			
3	28	0421G	SD-100	3	3	2			
3	28	0421G	SD-100	3	4	1			
3	28	0421G	SD-100	3	5	5			
3	28	0421G	SD-100	3	6	8			
3	28	0421G	SD-100	3	7	7			
3	28	0421G	SD-100	3	8	7			
3	28	0421G	SD-100	3	9	6			
3	28	0421G	SD-100	3	10	6	62		
4	14	0421G	SD-100	4	1	16			
4	14	0421G	SD-100	4	2	6			
4	14	0421G	SD-100	4	3	0			
4	14	0421G	SD-100	4	4	0			
4	14	0421G	SD-100	4	5	8			
4	14	0421G	SD-100	4	6	8			
4	14	0421G	SD-100	4	7	8			
4	14	0421G	SD-100	4	8	11			
4	14	0421G	SD-100	4	9	10			
4	14	0421G	SD-100	4	10	4	71		
5	55	0421G	SD-100	5	1	16			
5	55	0421G	SD-100	5	2	8			
5	55	0421G	SD-100	5	3	2		Mean	66.2
5	55	0421G	SD-100	5	4	4		SD	20.2
5	55	0421G	SD-100	5	5	8		n	5
5	55	0421G	SD-100	5	6	8			
5	55	0421G	SD-100	5	7	6			
5	55	0421G	SD-100	5	8	8			
5	55	0421G	SD-100	5	9	8			

*Data entry  
verified  
against  
laboratory  
bench sheets  
mkl  
3-16-06*

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
5	55	0421G	SD-100	5	10	5	73		
8	49	0422G	SD-101	1	1	18			
8	49	0422G	SD-101	1	2	17			
8	49	0422G	SD-101	1	3	10			
8	49	0422G	SD-101	1	4	8			
8	49	0422G	SD-101	1	5	8			
8	49	0422G	SD-101	1	6	10			
8	49	0422G	SD-101	1	7	7			
8	49	0422G	SD-101	1	8	7			
8	49	0422G	SD-101	1	9	6			
8	49	0422G	SD-101	1	10	3	94		
9	48	0422G	SD-101	2	1	17			
9	48	0422G	SD-101	2	2	5			
9	48	0422G	SD-101	2	3	2			
9	48	0422G	SD-101	2	4	7			
9	48	0422G	SD-101	2	5	0			
9	48	0422G	SD-101	2	6	5			
9	48	0422G	SD-101	2	7	7			
9	48	0422G	SD-101	2	8	0			
9	48	0422G	SD-101	2	9	0			
9	48	0422G	SD-101	2	10	4	47		
10	41	0422G	SD-101	3	1	18			
10	41	0422G	SD-101	3	2	15			
10	41	0422G	SD-101	3	3	8			
10	41	0422G	SD-101	3	4	3			
10	41	0422G	SD-101	3	5	10			
10	41	0422G	SD-101	3	6	10			
10	41	0422G	SD-101	3	7	5			
10	41	0422G	SD-101	3	8	5			
10	41	0422G	SD-101	3	9	6			
10	41	0422G	SD-101	3	10	6	86		
11	29	0422G	SD-101	4	1	17			
11	29	0422G	SD-101	4	2	19			
11	29	0422G	SD-101	4	3	11			
11	29	0422G	SD-101	4	4	5			
11	29	0422G	SD-101	4	5	8			
11	29	0422G	SD-101	4	6	7			
11	29	0422G	SD-101	4	7	9			
11	29	0422G	SD-101	4	8	9			
11	29	0422G	SD-101	4	9	10			
11	29	0422G	SD-101	4	10	4	99		
12	47	0422G	SD-101	5	1	14			
12	47	0422G	SD-101	5	2	8			
12	47	0422G	SD-101	5	3	3		Mean	79.2
12	47	0422G	SD-101	5	4	5		SD	21.1
12	47	0422G	SD-101	5	5	4		n	5
12	47	0422G	SD-101	5	6	9			
12	47	0422G	SD-101	5	7	7			
12	47	0422G	SD-101	5	8	7			
12	47	0422G	SD-101	5	9	8			
12	47	0422G	SD-101	5	10	5	70		



INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
15	46	0423G	SD-102	1	1	20			
15	46	0423G	SD-102	1	2	13			
15	46	0423G	SD-102	1	3	8			
15	46	0423G	SD-102	1	4	7			
15	46	0423G	SD-102	1	5	8			
15	46	0423G	SD-102	1	6	10			
15	46	0423G	SD-102	1	7	7			
15	46	0423G	SD-102	1	8	9			
15	46	0423G	SD-102	1	9	8			
15	46	0423G	SD-102	1	10	4	94		
16	23	0423G	SD-102	2	1	17			
16	23	0423G	SD-102	2	2	13			
16	23	0423G	SD-102	2	3	0			
16	23	0423G	SD-102	2	4	10			
16	23	0423G	SD-102	2	5	10			
16	23	0423G	SD-102	2	6	10			
16	23	0423G	SD-102	2	7	11			
16	23	0423G	SD-102	2	8	12			
16	23	0423G	SD-102	2	9	11			
16	23	0423G	SD-102	2	10	12	106		
17	34	0423G	SD-102	3	1	20			
17	34	0423G	SD-102	3	2	15			
17	34	0423G	SD-102	3	3	5			
17	34	0423G	SD-102	3	4	6			
17	34	0423G	SD-102	3	5	6			
17	34	0423G	SD-102	3	6	8			
17	34	0423G	SD-102	3	7	7			
17	34	0423G	SD-102	3	8	7			
17	34	0423G	SD-102	3	9	8			
17	34	0423G	SD-102	3	10	7	89		
18	6	0423G	SD-102	4	1	20			
18	6	0423G	SD-102	4	2	13			
18	6	0423G	SD-102	4	3	5			
18	6	0423G	SD-102	4	4	3			
18	6	0423G	SD-102	4	5	3			
18	6	0423G	SD-102	4	6	2			
18	6	0423G	SD-102	4	7	2			
18	6	0423G	SD-102	4	8	2			
18	6	0423G	SD-102	4	9	2			
18	6	0423G	SD-102	4	10	3	55		
19	25	0423G	SD-102	5	1	19			
19	25	0423G	SD-102	5	2	12			
19	25	0423G	SD-102	5	3	7		Mean	85.2
19	25	0423G	SD-102	5	4	8		SD	19.0
19	25	0423G	SD-102	5	5	5		n	5
19	25	0423G	SD-102	5	6	6			
19	25	0423G	SD-102	5	7	5			
19	25	0423G	SD-102	5	8	7			
19	25	0423G	SD-102	5	9	8			
19	25	0423G	SD-102	5	10	5	82		
22	19	0424G	SD-103	1	1	1			

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
22	19	0424G	SD-103	1	2	0			
22	19	0424G	SD-103	1	3	0			
22	19	0424G	SD-103	1	4	1			
22	19	0424G	SD-103	1	5	0			
22	19	0424G	SD-103	1	6	3			
22	19	0424G	SD-103	1	7	0			
22	19	0424G	SD-103	1	8	0			
22	19	0424G	SD-103	1	9	0			
22	19	0424G	SD-103	1	10	0	5		
23	51	0424G	SD-103	2	1	13			
23	51	0424G	SD-103	2	2	9			
23	51	0424G	SD-103	2	3	5			
23	51	0424G	SD-103	2	4	0			
23	51	0424G	SD-103	2	5	3			
23	51	0424G	SD-103	2	6	0			
23	51	0424G	SD-103	2	7	0			
23	51	0424G	SD-103	2	8	0			
23	51	0424G	SD-103	2	9	0			
23	51	0424G	SD-103	2	10	0	30		
24	18	0424G	SD-103	3	1	4			
24	18	0424G	SD-103	3	2	2			
24	18	0424G	SD-103	3	3	2			
24	18	0424G	SD-103	3	4	5			
24	18	0424G	SD-103	3	5	3			
24	18	0424G	SD-103	3	6	0			
24	18	0424G	SD-103	3	7	0			
24	18	0424G	SD-103	3	8	0			
24	18	0424G	SD-103	3	9	0			
24	18	0424G	SD-103	3	10	0	16		
25	52	0424G	SD-103	4	1	12			
25	52	0424G	SD-103	4	2	1			
25	52	0424G	SD-103	4	3	2			
25	52	0424G	SD-103	4	4	0			
25	52	0424G	SD-103	4	5	0			
25	52	0424G	SD-103	4	6	1			
25	52	0424G	SD-103	4	7	0			
25	52	0424G	SD-103	4	8	0			
25	52	0424G	SD-103	4	9	0			
25	52	0424G	SD-103	4	10	1	17		
26	11	0424G	SD-103	5	1	1			
26	11	0424G	SD-103	5	2	5			
26	11	0424G	SD-103	5	3	3		Mean	15.6
26	11	0424G	SD-103	5	4	1		SD	9.4
26	11	0424G	SD-103	5	5	0		n	5
26	11	0424G	SD-103	5	6	0			
26	11	0424G	SD-103	5	7	0			
26	11	0424G	SD-103	5	8	0			
26	11	0424G	SD-103	5	9	0			
26	11	0424G	SD-103	5	10	0	10		
29	39	0425G	SD-104	1	1	1			
29	39	0425G	SD-104	1	2	2			

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
29	39	0425G	SD-104	1	3	0			
29	39	0425G	SD-104	1	4	0			
29	39	0425G	SD-104	1	5	0			
29	39	0425G	SD-104	1	6	1			
29	39	0425G	SD-104	1	7	0			
29	39	0425G	SD-104	1	8	0			
29	39	0425G	SD-104	1	9	0			
29	39	0425G	SD-104	1	10	0	4		
30	20	0425G	SD-104	2	1	0			
30	20	0425G	SD-104	2	2	0			
30	20	0425G	SD-104	2	3	0			
30	20	0425G	SD-104	2	4	0			
30	20	0425G	SD-104	2	5	0			
30	20	0425G	SD-104	2	6	0			
30	20	0425G	SD-104	2	7	0			
30	20	0425G	SD-104	2	8	0			
30	20	0425G	SD-104	2	9	0			
30	20	0425G	SD-104	2	10	0	0		
31	33	0425G	SD-104	3	1	0			
31	33	0425G	SD-104	3	2	2			
31	33	0425G	SD-104	3	3	0			
31	33	0425G	SD-104	3	4	0			
31	33	0425G	SD-104	3	5	0			
31	33	0425G	SD-104	3	6	0			
31	33	0425G	SD-104	3	7	0			
31	33	0425G	SD-104	3	8	0			
31	33	0425G	SD-104	3	9	0			
31	33	0425G	SD-104	3	10	0	2		
32	15	0425G	SD-104	4	1	2			
32	15	0425G	SD-104	4	2	1			
32	15	0425G	SD-104	4	3	0			
32	15	0425G	SD-104	4	4	0			
32	15	0425G	SD-104	4	5	0			
32	15	0425G	SD-104	4	6	0			
32	15	0425G	SD-104	4	7	0			
32	15	0425G	SD-104	4	8	3			
32	15	0425G	SD-104	4	9	4			
32	15	0425G	SD-104	4	10	1	11		
33	31	0425G	SD-104	5	1	3			
33	31	0425G	SD-104	5	2	3			
33	31	0425G	SD-104	5	3	0		Mean	5.8
33	31	0425G	SD-104	5	4	1		SD	5.4
33	31	0425G	SD-104	5	5	1		n	5
33	31	0425G	SD-104	5	6	1			
33	31	0425G	SD-104	5	7	0			
33	31	0425G	SD-104	5	8	1			
33	31	0425G	SD-104	5	9	2			
33	31	0425G	SD-104	5	10	0	12		
36	1	0426G	REF-EBB	1	1	1			
36	1	0426G	REF-EBB	1	2	0			
36	1	0426G	REF-EBB	1	3	2			

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
36	1	0426G	REF-EBB	1	4	0			
36	1	0426G	REF-EBB	1	5	0			
36	1	0426G	REF-EBB	1	6	0			
36	1	0426G	REF-EBB	1	7	0			
36	1	0426G	REF-EBB	1	8	0			
36	1	0426G	REF-EBB	1	9	1			
36	1	0426G	REF-EBB	1	10	1	5		
37	26	0426G	REF-EBB	2	1	0			
37	26	0426G	REF-EBB	2	2	0			
37	26	0426G	REF-EBB	2	3	0			
37	26	0426G	REF-EBB	2	4	0			
37	26	0426G	REF-EBB	2	5	0			
37	26	0426G	REF-EBB	2	6	0			
37	26	0426G	REF-EBB	2	7	0			
37	26	0426G	REF-EBB	2	8	0			
37	26	0426G	REF-EBB	2	9	0			
37	26	0426G	REF-EBB	2	10	0	0		
38	37	0426G	REF-EBB	3	1	0			
38	37	0426G	REF-EBB	3	2	1			
38	37	0426G	REF-EBB	3	3	2			
38	37	0426G	REF-EBB	3	4	0			
38	37	0426G	REF-EBB	3	5	0			
38	37	0426G	REF-EBB	3	6	1			
38	37	0426G	REF-EBB	3	7	0			
38	37	0426G	REF-EBB	3	8	0			
38	37	0426G	REF-EBB	3	9	0			
38	37	0426G	REF-EBB	3	10	2	6		
39	42	0426G	REF-EBB	4	1	1			
39	42	0426G	REF-EBB	4	2	0			
39	42	0426G	REF-EBB	4	3	0			
39	42	0426G	REF-EBB	4	4	0			
39	42	0426G	REF-EBB	4	5	7			
39	42	0426G	REF-EBB	4	6	0			
39	42	0426G	REF-EBB	4	7	0			
39	42	0426G	REF-EBB	4	8	0			
39	42	0426G	REF-EBB	4	9	0			
39	42	0426G	REF-EBB	4	10	0	8		
40	8	0426G	REF-EBB	5	1	0			
40	8	0426G	REF-EBB	5	2	0			
40	8	0426G	REF-EBB	5	3	0		Mean	4.2
40	8	0426G	REF-EBB	5	4	0		SD	3.2
40	8	0426G	REF-EBB	5	5	0		n	5
40	8	0426G	REF-EBB	5	6	0			
40	8	0426G	REF-EBB	5	7	0			
40	8	0426G	REF-EBB	5	8	0			
40	8	0426G	REF-EBB	5	9	0			
40	8	0426G	REF-EBB	5	10	2	2		
43	56	0427G	REF-YB	1	1	0			
43	56	0427G	REF-YB	1	2	0			
43	56	0427G	REF-YB	1	3	0			
43	56	0427G	REF-YB	1	4	0			

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
43	56	0427G	REF-YB	1	5	0			
43	56	0427G	REF-YB	1	6	0			
43	56	0427G	REF-YB	1	7	0			
43	56	0427G	REF-YB	1	8	0			
43	56	0427G	REF-YB	1	9	0			
43	56	0427G	REF-YB	1	10	0	0		
44	17	0427G	REF-YB	2	1	0			
44	17	0427G	REF-YB	2	2	0			
44	17	0427G	REF-YB	2	3	0			
44	17	0427G	REF-YB	2	4	1			
44	17	0427G	REF-YB	2	5	0			
44	17	0427G	REF-YB	2	6	0			
44	17	0427G	REF-YB	2	7	0			
44	17	0427G	REF-YB	2	8	0			
44	17	0427G	REF-YB	2	9	1			
44	17	0427G	REF-YB	2	10	2	4		
45	16	0427G	REF-YB	3	1	0			
45	16	0427G	REF-YB	3	2	0			
45	16	0427G	REF-YB	3	3	0			
45	16	0427G	REF-YB	3	4	0			
45	16	0427G	REF-YB	3	5	0			
45	16	0427G	REF-YB	3	6	0			
45	16	0427G	REF-YB	3	7	0			
45	16	0427G	REF-YB	3	8	0			
45	16	0427G	REF-YB	3	9	0			
45	16	0427G	REF-YB	3	10	0	0		
46	12	0427G	REF-YB	4	1	0			
46	12	0427G	REF-YB	4	2	0			
46	12	0427G	REF-YB	4	3	0			
46	12	0427G	REF-YB	4	4	3			
46	12	0427G	REF-YB	4	5	0			
46	12	0427G	REF-YB	4	6	0			
46	12	0427G	REF-YB	4	7	0			
46	12	0427G	REF-YB	4	8	0			
46	12	0427G	REF-YB	4	9	0			
46	12	0427G	REF-YB	4	10	0	3		
47	21	0427G	REF-YB	5	1	0			
47	21	0427G	REF-YB	5	2	0			
47	21	0427G	REF-YB	5	3	0		Mean	1.4
47	21	0427G	REF-YB	5	4	0		SD	1.9
47	21	0427G	REF-YB	5	5	0		n	5
47	21	0427G	REF-YB	5	6	0			
47	21	0427G	REF-YB	5	7	0			
47	21	0427G	REF-YB	5	8	0			
47	21	0427G	REF-YB	5	9	0			
47	21	0427G	REF-YB	5	10	0	0		
50	35	0438G	control	1	1	0			
50	35	0438G	control	1	2	0			
50	35	0438G	control	1	3	0			
50	35	0438G	control	1	4	0			
50	35	0438G	control	1	5	0			

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	EMERG	TOTAL EMERG		
50	35	0438G	control	1	6	0			
50	35	0438G	control	1	7	0			
50	35	0438G	control	1	8	0			
50	35	0438G	control	1	9	0			
50	35	0438G	control	1	10	0	0		
51	24	0438G	control	2	1	0			
51	24	0438G	control	2	2	0			
51	24	0438G	control	2	3	0			
51	24	0438G	control	2	4	0			
51	24	0438G	control	2	5	0			
51	24	0438G	control	2	6	0			
51	24	0438G	control	2	7	0			
51	24	0438G	control	2	8	0			
51	24	0438G	control	2	9	0			
51	24	0438G	control	2	10	0	0		
52	2	0438G	control	3	1	0			
52	2	0438G	control	3	2	0			
52	2	0438G	control	3	3	0			
52	2	0438G	control	3	4	0			
52	2	0438G	control	3	5	0			
52	2	0438G	control	3	6	0			
52	2	0438G	control	3	7	0			
52	2	0438G	control	3	8	0			
52	2	0438G	control	3	9	0			
52	2	0438G	control	3	10	0	0		
53	54	0438G	control	4	1	0			
53	54	0438G	control	4	2	0			
53	54	0438G	control	4	3	0			
53	54	0438G	control	4	4	0			
53	54	0438G	control	4	5	0			
53	54	0438G	control	4	6	0			
53	54	0438G	control	4	7	0			
53	54	0438G	control	4	8	0			
53	54	0438G	control	4	9	0			
53	54	0438G	control	4	10	0	0		
54	10	0438G	control	5	1	0			
54	10	0438G	control	5	2	0			
54	10	0438G	control	5	3	0		Mean	0.0
54	10	0438G	control	5	4	0		SD	0.0
54	10	0438G	control	5	5	0		n	5
54	10	0438G	control	5	6	0			
54	10	0438G	control	5	7	0			
54	10	0438G	control	5	8	0			
54	10	0438G	control	5	9	0			
54	10	0438G	control	5	10	0	0		

*Data entry verified against laboratory bench sheets - MAR 316 06*

## Water Quality Data

Water Quality Data																								
		Overlying water										Interstitial										assumed		
NAS	CLIENT	REPL	DAY	TEMP	pH	SAL	DO	S	< or >	NH4+NH3	< or >	NH3	pH	SAL	S	< or >	NH4+NH3	< or >	NH3	temp.				
BKR	SMPL	DESCRIP																						
bulk	0421G	SD-100											6.9	1.5	<0.1		6.1		0.016		15			
bulk	0422G	SD-101											7.1	3.0	<0.1		13.2		0.054					
bulk	0423G	SD-102											7.4	1.0	<0.1		3.0		0.025					
bulk	0424G	SD-103											7.2	4.5	<0.1		10.8		0.055					
bulk	0425G	SD-104											7.3	5.0	<0.1		14.1		0.089					
bulk	0426G	REF-EBB											7.2	5.0	<0.1		12.0		0.061					
bulk	0427G	REF-YB											7.7	7.0	<0.1		12.9		0.202					
4	0423G	SD-102	7	0									6.5	13.0			5.4		0.005					
30	0426G	REF-EBB	7	0									6.5	14.0			17.1		0.016					
32	0427G	REF-YB	7	0									7.2	16.0			16.6		0.078					
36	0422G	SD-101	7	0									6.6	14.0			19.2		0.023					
40	0438G	control	7	0									7.6	23.0			0.7		0.008					
44	0424G	SD-103	7	0									6.8	15.0			17.5		0.033					
50	0425G	SD-104	7	0									6.7	16.0			16.0		0.024					
53	0421G	SD-100	7	0									6.6	14.0			7.9		0.009					
3	0421G	SD-100	6	0	14.8	7.9	26.5	8.5	<0.1	1.6		0.125												
5	0424G	SD-103	6	0	14.9	7.8	26.5	8.5	<0.1	2.8		0.224												
7	0438G	control	6	0	14.9	7.8	26.5	8.4	<0.1	0.2		0.012												
9	0425G	SD-104	6	0	14.9	7.6	26.5	8.6	<0.1	3.1		0.311												
27	0426G	REF-EBB	6	0	14.9	7.7	26.0	8.3	<0.1	2.5		0.130												
38	0423G	SD-102	6	0	14.9	7.7	25.0	8.0	<0.1	1.0		0.026												
43	0422G	SD-101	6	0	15.0	7.7	26.5	8.4	<0.1	2.8		0.181												
45	0427G	REF-YB	6	0	15.1	7.9	27.0	8.4	<0.1	2.9		0.191												
3	0421G	SD-100	6	1	14.9	7.7	27.0	8.0																
5	0424G	SD-103	6	1	15.3	7.0	26.5	8.0																
7	0438G	control	6	1	15.1	7.9	27.0	8.2																
9	0425G	SD-104	6	1	15.1	7.9	26.5	8.1																
27	0426G	REF-EBB	6	1	15.3	7.6	26.0	7.8																
38	0423G	SD-102	6	1	15.5	7.7	25.0	7.8																
43	0422G	SD-101	6	1	15.5	7.6	26.0	7.8																
45	0427G	REF-YB	6	1	15.2	8.0	26.0	8.1																
3	0421G	SD-100	6	2	14.8	7.8	26.5	8.3																
5	0424G	SD-103	6	2	15.1	7.8	26.0	8.3																
7	0438G	control	6	2	14.9	8.0	27.0	8.3																
9	0425G	SD-104	6	2	14.8	7.9	26.0	8.4																
27	0426G	REF-EBB	6	2	15.1	7.8	26.0	8.0																
38	0423G	SD-102	6	2	15.3	7.8	25.0	8.1																
43	0422G	SD-101	6	2	15.4	7.7	25.5	8.0																
45	0427G	REF-YB	6	2	15.3	8.0	26.0	8.2																
3	0421G	SD-100	6	3	14.8	7.6	28.0																	

Marine Amphipod Test

Test No. 738-1

NAS		CLIENT	Overlying water				Interstitial				Interstitial										
BKR	SMPL	DESCRIP	REPL	DAY	TEMP	pH	SAL	DO	S	< or >	NH4+NH3	< or >	NH3	pH	SAL	S	< or >	NH4+NH3	< or >	NH3	temp.
5	0424G	SD-103	6	3	14.9	7.7	27.5														
7	0438G	control	6	3	14.8	7.9	28.0														
9	0425G	SD-104	6	3	14.8	7.8	28.0														
27	0426G	REF-EBB	6	3	14.4	7.6	26.0														
38	0423G	SD-102	6	3	15.0	7.6	26.0														
43	0422G	SD-101	6	3	15.0	7.6	26.0														
45	0427G	REF-YB	6	3	15.0	7.9	27.0														
3	0421G	SD-100	6	4	15.3	7.6	28.0														
5	0424G	SD-103	6	4	15.2	7.7	28.5														
7	0438G	control	6	4	15.5	7.8	28.0														
9	0425G	SD-104	6	4	15.2	7.8	28.0														
27	0426G	REF-EBB	6	4	15.4	7.7	27.0														
38	0423G	SD-102	6	4	15.8	7.6	25.0														
43	0422G	SD-101	6	4	15.5	7.6	26.0														
45	0427G	REF-YB	6	4	15.5	7.6	27.0														
3	0421G	SD-100	6	5	16.0	7.6	29.0	8.0													
5	0424G	SD-103	6	5	16.0	7.7	29.0	8.0													
7	0438G	control	6	5	16.0	7.9	29.0	8.0													
9	0425G	SD-104	6	5	16.0	7.9	29.0	8.2													
27	0426G	REF-EBB	6	5	16.0	7.8	27.0	8.0													
38	0423G	SD-102	6	5	16.2	7.8	26.0	7.8													
43	0422G	SD-101	6	5	16.2	7.7	26.0	7.8													
45	0427G	REF-YB	6	5	16.2	8.0	27.0	8.0													
3	0421G	SD-100	6	6	15.9	7.6	29.0	7.7													
5	0424G	SD-103	6	6	16.0	7.8	29.5	7.7													
7	0438G	control	6	6	15.9	8.0	30.5	7.8													
9	0425G	SD-104	6	6	15.7	7.9	30.0	7.8													
27	0426G	REF-EBB	6	6	16.0	7.9	29.0	7.8													
38	0423G	SD-102	6	6	16.0	7.7	26.0	7.6													
43	0422G	SD-101	6	6	16.3	7.7	26.0	7.4													
45	0427G	REF-YB	6	6	16.2	8.0	27.0	7.8													
3	0421G	SD-100	6	7	15.4	7.7	30.0	7.8													
5	0424G	SD-103	6	7	15.6	7.8	30.0	7.9													
7	0438G	control	6	7	15.6	8.0	30.0	7.8													
9	0425G	SD-104	6	7	15.7	8.0	30.0	7.8													
27	0426G	REF-EBB	6	7	15.7	8.0	29.0	8.0													
38	0423G	SD-102	6	7	16.0	7.7	27.5	7.6													
43	0422G	SD-101	6	7	16.0	7.7	27.0	7.4													
45	0427G	REF-YB	6	7	16.0	8.0	29.0	7.9													
3	0421G	SD-100	6	8	15.2	7.6	30.0	7.7													
5	0424G	SD-103	6	8	15.4	7.8	30.5	7.8													
7	0438G	control	6	8	15.4	8.0	30.0	7.6													
9	0425G	SD-104	6	8	15.4	8.0	30.0	7.9													
27	0426G	REF-EBB	6	8	15.5	8.0	29.0	7.9													



NAS		CLIENT	Overlying water										Interstitial					interstitial temp.		
BKR	SMPL	DESCRIP	REPL	DAY	TEMP	pH	SAL	DO	S	< or >	NH4+NH3	< or >	NH3	pH	SAL	S	< or >	NH4+NH3	< or >	NH3
38	0423G	SD-102	6	8	15.6	7.8	28.0	7.7												
43	0422G	SD-101	6	8	15.8	7.8	27.5	7.6												
45	0427G	REF-YB	6	8	15.8	8.1	29.5	7.9												
3	0421G	SD-100	6	9	15.4	7.7	30.0	7.6												
5	0424G	SD-103	6	9	15.5	7.9	30.5	7.6												
7	0438G	control	6	9	15.5	8.0	30.5	7.7												
9	0425G	SD-104	6	9	15.5	8.1	30.5	7.8												
27	0426G	REF-EBB	6	9	15.6	8.1	29.5	7.8												
38	0423G	SD-102	6	9	15.6	7.9	29.0	7.9												
43	0422G	SD-101	6	9	15.8	7.7	28.0	7.7												
45	0427G	REF-YB	6	9	15.9	8.1	30.0	7.8												
3	0421G	SD-100	6	10	14.9	7.7	30.0	8.0	<0.1		1.7		0.044	6.7	28.0			22.5		0.031
5	0424G	SD-103	6	10	14.6	8.1	29.5	8.0	<0.1		2.3		0.058	6.5	28.0			34.4		0.030
7	0438G	control	6	10	14.8	7.9	31.0	8.1	<0.1		0.1		0.004	7.6	27.5			2.2		0.023
9	0425G	SD-104	6	10	14.7	8.1	30.0	8.2	<0.1		1.1		0.042	6.4	29.0			30.1		0.020
27	0426G	REF-EBB	6	10	14.8	8.1	28.0	8.2												
37	0426G	REF-EBB	3	10					<0.1		1.7			6.6	27.0			11.2		
38	0423G	SD-102	6	10	15.1	7.9	25.0	8.2	<0.1		0.3		0.013	6.4	25.0			28.4		0.020
43	0422G	SD-101	6	10	15.0	8.1	26.0	8.2	<0.1		4.5		0.191	6.4	26.0			44.1		0.030
45	0427G	REF-YB	6	10	14.9	8.1	28.0	8.0	<0.1		2.0		0.054	7.0	27.0			38.7		0.106
														Interstitial summary statistics don't include bulk values.						
Mean					15.4	7.8	27.8	8.0	---		---		---	6.8	21.4			---		---
SD					0.5	0.2	1.7	0.3	---		---		---	0.4	6.4			---		---
n					88	88	88	72	16		16		15	16	16			16		15
Min					14.4	7.0	25.0	7.4	<0.1		0.1		0.004	6.4	13.0			0.7		0.005
Max					16.3	8.1	31.0	8.6	<0.1		4.5		0.311	7.6	29.0			44.1		0.106

**CHAIN-OF-CUSTODY RECORDS**

## Sample Chain-of-Custody/Analysis Request

## Possible Hazards

Client EnviroLogic Resources Report to Taku Fuji  
 Site Astoria Area - Wide Company Kennedy/Jenks  
 Project No. 0592004.00 Address 200 SW Market St. #500  
 Sampler Name Tom Pinit / Cindy Ryals Portland, OR 97201  
 Telephone 503-295-4911 Fax 503-295-4901

Lab Destination Northwestern Aquatic Sciences  
 Address 3814 Yaquina Bay Rd.  
NWPORT, OR 97365  
 Telephone 541-265-7225  
 Carrier/Way Bill No. \_\_\_\_\_

(1) Lab ID No.		(4) Client ID No.		(2) Collection Date		(3) Time		(5) Analysis Requested		Comment/Conditions (container type, container number, etc.)	
Lab ID No.	Client ID No.	Date	Time	Type	Depth	Comp.	Pres.	Time	Turn	Container type	Number
SD-100	112406	1145	S	0421G						Measure interstitial	5 x 1-L glass
SD-101	1220	S	0422G							ammonia & sulfide	
SD-102	1300	S	0423G							upon receipt	
SD-103	1330	S	0424G							Hold until further	
SD-104	1400	S	0425G							directed (awaiting	
REF-EBB	1630	S	0426G							chemical analyses)	
REF-YB	1510	S	0427G							Reference	
										Reference	
										jars were full (no head space)	
										cooler temperatures: 1.5°C, 3.0°C, 2.0°C	

(4) Preservation of sample.

(5) Write each analysis requested across top. Place an "X" in appropriate column to indicate type of analysis needed for each sample.

(1) Write only one sample number in each space.  
 (2) Specify type of sample(s): Water (W), Solid (S), or indicate type.  
 (3) Mark each sample which should be composited in Laboratory as follows: Place an "X" in box for each sample that should be composited into one sample; use sequential letter for additional groups.

Sample Requested By				Sample Received By			
Print Name	Signature	Company	Date	Print Name	Signature	Company	Date
P. THOMAS PINIT	P. Jedd/eb	K/J	11/27/06	1240 Michele S. Redmond	Michele S. Redmond	NAS	1/27-06 13:45

## REFERENCE TOXICANT RESULTS AND ANALYSIS

## ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999- 2085 Client: \_\_\_\_\_ QC TestInvestigator pgs 1-6 mkrTest Type (ranging/definitive) definitiveTest Length (hr) 483-16-06Species Eohaustorius estuarius

## STUDY MANAGEMENT

Client: QC TestClient's Study Monitor: N/ATesting Laboratory: Northwestern Aquatic SciencesTest Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir. M.S. Redmond mkrQA Officer L.K. Nemeth1. G.J. IRISSARRI GJI2. Greg Hutchinson GH

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

Study Schedule:

Test Beginning: 2-17-06 11:15Test Ending: 2-19-06 1055

## TEST MATERIAL

Description: SDS (sodium dodecyl sulfate), Sigma lot #17H0459, 1.0 mg/ml stock prepared: 2-17-06

## DILUTION WATER

Description: Yaquina Bay, Oregon, sea waterDate of Preparation/Collection: 2-15-06Water Quality: Salinity (ppt) 28.0 pH \_\_\_\_\_Treatments: Filtered to 0.4  $\mu$ m, salinity adjusted with Milli-Q deionized water, aerated

## TEST LOCATION

Test conducted in (circle one): room 1 room 2 trailer water bath other: Room #4

Randomization chart:

REP	B	120	15	$\phi$	60	30	240				
	A	60	240	30	15	120	$\phi$				

Error codes: 1) Correction of handwriting error

2) Written in wrong location; entry deleted

3) Wrong date deleted; replaced with correct date

4) Error found in measurement; measurement repeated

NORTHWESTERN AQUATIC SCIENCES  
ACUTE TOXICITY TEST (ALL SPECIES)

PROTOCOL NO. NAS-XXX-RA1

Test No. 999-2085 Client: QC Test Investigator

TEST ORGANISMS

Species: Eohaustorius estuarius Age: adult Size:   
Source: Yaquina Bay, Oregon

Date Collected: 2-14-06  
Field conditions:  Interstitial temperature: 6.0 °C Interstitial salinity: 18.0 ‰

Acclimation Data:

Date	Temp. (deg.C)	pH	Sal. (ppt)	DO (mg/L)	Feeding		Water changes	Comments
					amount	description		
2-14-06	12.6	7.8	23.5	9.2			yes	
2-15-06	14.0	7.9	28.5	8.6			yes	
2-16-06	13.9	7.8	29.0	8.7				
2-17-06	14.1	8.0	29.0	8.7				
Mean	13.6	7.9	27.5	8.8				
S.D.	0.7	0.1	2.7	0.3				
(N)	4	4	4	4				

Photoperiod during acclimation: Constant light

TEST PROCEDURES AND CONDITIONS

Test concentrations (50% series recommended): 240, 120, 60, 30, 15 and 0 mg/L  
Test chamber: 250 mL beakers Test volume: 100 mL  
Replicates/treatment: 2 Organisms/treatment: 20 (10/repl)  
Test water changes: None Aeration during test: None  
Feeding: None

Duration: 24-hr 48-hr 96-hr Test temperature (deg.C): 15.0 +/- 1.0  
Beaker placement: Stratified randomization Photoperiod: Constant light  
Test salinity (ppt): 28.0 +/- 1.0

MISCELLANEOUS NOTES

Test Solution Preparation:

Working stock made by adding 0.10 g of SDS to a 100mL volumetric flask and diluting to 100 mLs with dilution water; final concentration = 1.0 mg/mL

Test Conc. (mg SDS/L)	mL of SDS working stock (1.0 mg/mL) per 200 mL		
240	48		Bring up to 200mL with dilution water, then split between 2 replicates
120	24		
60	12		
30	6		
15	3		
0	0		

Light intensity measurements:  Date  Location  foot-candles

## ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2085 Client QC Test Investigator                     

## DAILY RECORD SHEET

Day 0 (2/17/06) GH / MRL

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors	
					A	B
1. 240	15.0	7.9	27.5	9.7	10	10
2. 120	15.2	7.8	28.0	9.7	10	10
3. 60	15.0	7.9	27.5	9.7	10	10
4. 30	15.2	7.9	28.0	9.7	10	10
5. 15	15.3	7.9	27.0	9.6	10	10
6. 0	15.5	7.9	27.0	9.7	10	10

Day 1 (2/18/06) 651

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors	
					A	B
1. 240	15.5	7.6	28.0	6.6	0 (100)	0 (100)
2. 120	15.4	7.8	28.0	7.6	0 (100)	0 (100)
3. 60	15.2	7.8	28.0	7.9	10	10
4. 30	15.0	7.8	27.5	7.9	10	10
5. 15	15.2	7.7	27.5	7.7	10	10
6. 0	15.4	7.7	27.0	8.0	10	10

Day 2 (2/19/06) 652

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors	
					A	B
1. 240	—	—	—	—	0	0
2. 120	—	—	—	—	0	0
3. 60	15.0	7.8	28.0	7.3	8 (20)	8 (20)
4. 30	14.8	7.8	28.0	7.4	10	10
5. 15	14.9	7.8	28.0	7.8	10	10
6. 0	15.2	7.9	27.5	8.0	10	10

WQ: Mean 15.2 7.8 27.7 8.4  
 SD 0.2 0.1 0.4 1.1  
 n 16 16 16 16

## CETIS Test Summary

Report Date:

28 Feb-06 11:36 AM

Test Link:

14-9199-1687/999-2085

## Reference Toxicant 48-h Acute Survival Test

Northwestern Aquatic Sciences

Test No: 06-5785-2836	Test Type: Survival (48h)	Duration: 48h
Start Date: 17 Feb-06 11:15 AM	Protocol:	Species: Eohaustorius estuarius
Ending Date: 19 Feb-06 10:55 AM	Dil Water: Yaquina Bay Seawater	Source: Field Collected
Setup Date: 17 Feb-06 11:15 AM	Brine:	

Sample No: 03-1281-0255	Material: Sodium dodecyl sulfate	Client: QC Test
Sample Date: 17 Feb-06 11:15 AM	Code: 312810255	Project:
Receive Date:	Source: Reference Toxicant	
Sample Age: N/A	Station:	

## Point Estimate Summary

Analysis	Endpoint	% Effect	Conc-mg/L	95% LCL	95% UCL	Method
08-4883-1248	48h Proportion Survived	50	73.86867	65.25449	83.62	Trimmed Spearman-Kärber

## 48h Proportion Survived Summary

Conc-mg/L	Control Type	Reps	Mean	Minimum	Maximum	SE	SD	CV
0	Dilution Water	2	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
15		2	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
30		2	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
60		2	0.80000	0.80000	0.80000	0.00000	0.00000	0.00%
120		2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%
240		2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%

## 48h Proportion Survived Detail

Conc-mg/L	Control Type	Rep 1	Rep 2
0	Dilution Water	1.00000	1.00000
15		1.00000	1.00000
30		1.00000	1.00000
60		0.80000	0.80000
120		0.00000	0.00000
240		0.00000	0.00000



## CETIS Data Worksheet

Report Date: 28 Feb-06 11:34 AM

Link: 14-9199-1687/999-2085

Reference Toxicant 48-h Acute Survival Test						Northwestern Aquatic Sciences	
Start Date:	17 Feb-06 11:15 AM	Species:	Eohaustorius estuarius		Sample Code:	312810255	
Ending Date:	19 Feb-06 10:55 AM	Protocol:			Sample Source:	Reference Toxicant	
Sample Date:	17 Feb-06 11:15 AM	Material:	Sodium dodecyl sulfate		Sample Station:		
Conc-mg/L	Code	Rep	Pos	# Exposed	24h Survival	48h Survival	Notes
0	D	1	3	10		10	
0	D	2	4	10		10	
15		1	8	10		10	
15		2	10	10		10	
30		1	6	10		10	
30		2	2	10		10	
60		1	12	10		8	
60		2	5	10		8	
120		1	11	10		0	
120		2	1	10		0	
240		1	7	10		0	
240		2	9	10		0	

*Data entry verified against laboratory bench sheets.*

*MUR*  
*2-28-06*

# CETIS QC Chart

Page 1 of 1

Report Date: 28 Feb-06 11:39 AM

Eohaustorius estuarius 48-hr reference toxicant test

Northwestern Aquatic Sciences

Test Type: Survival (48h)

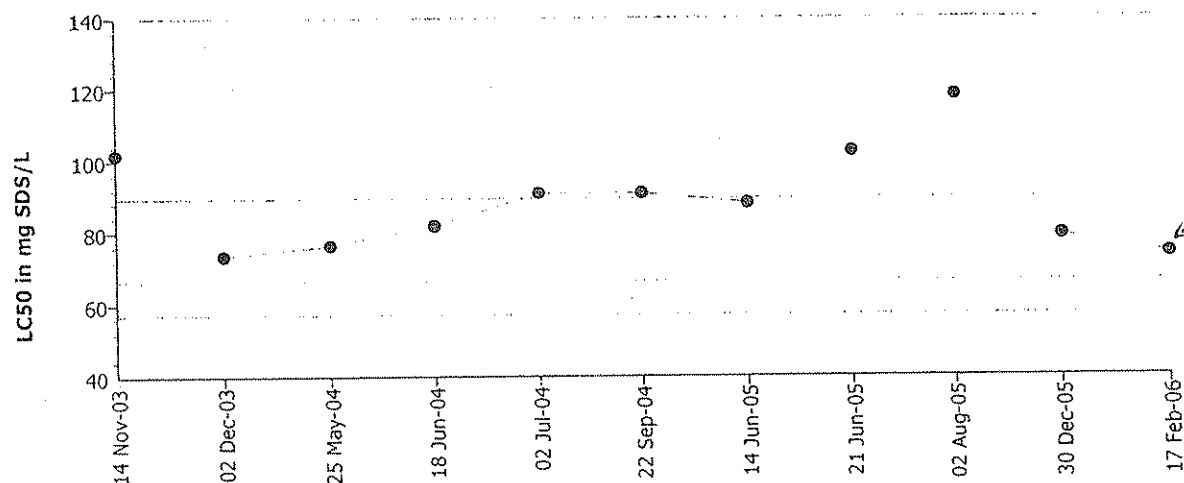
Organism: Eohaustorius estuarius (Amphipod)

Material: Sodium dodecyl sulfate

Protocol: All Protocols

Endpoint: 48h Proportion Survived

Source: Reference Toxicant-REF



Mean: 89.4533

Count: 11

-2s Warning Limit: 66.4300

-3s Action Limit: 57.2464

Sigma:

CV: 16.04%

+2s Warning Limit: 120.456

+3s Action Limit: 139.78

## Quality Control Data

Point	Year	Month	Day	Data	Delta	Sigma	Warning	Action	Test Link	Analysis
1	2003	Nov	14	101.8234	12.37011	0.87055			11-2849-7058	10-7764-0044
2		Dec	2	73.50846	-15.9448	-1.31947			11-9302-7143	01-7610-0076
3	2004	May	25	76.47364	-12.9796	-1.05368			02-7358-5242	05-0191-3920
4		Jun	18	81.96242	-7.49087	-0.58780			11-0497-2342	18-8553-9316
5		Jul	2	90.94299	1.48970	0.11101			02-3350-6107	07-5862-0065
6		Sep	22	90.94299	1.48970	0.11101			12-8958-0291	05-6981-1512
7	2005	Jun	14	88.18407	-1.26922	-0.09605			08-7943-6470	07-6334-9178
8			21	102.4745	13.02121	0.91339			13-8005-2450	05-4939-2508
9		Aug	2	118.1801	28.72681	1.87180			07-7852-2182	13-9980-7686
10		Dec	30	79.17047	-10.2828	-0.82074			15-5965-2502	12-3824-7721
11	2006	Feb	17	73.86867	-15.5846	-1.28662			14-9199-1687	08-4883-1248

MR  
2-28-06

**Report**  
**of**  
**Test No. 738-2**  
**Juvenile *Neanthes* 20-Day Sediment Toxicity**  
**Test of Marine Sediments**

**Submitted to**  
**Kennedy/Jenks Consultants**  
**200 S.W. Market St., Suite 500**  
**Portland, OR 97201**

**Submitted By**  
**Northwestern Aquatic Sciences**  
**3814 Yaquina Bay Road**  
**P.O. Box 1437**  
**Newport, OR 97365**

**June 13, 2006**

## TOXICITY TEST REPORT

## TEST IDENTIFICATION

Test No.: 738-2

Title: Juvenile *Neanthes* 20-day sediment toxicity test of estuarine sediments.

Protocol: NAS-XXX-NA4, June 20, 1990. Rev. 4 (3-1-05). Based on: Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments (PSEP 1995), with modifications as specified by the Dredged Material Management Program (DMMP, formerly Puget Sound Dredged Disposal Analysis Program or PSDDA).

## STUDY MANAGEMENT

Study Sponsor: Kennedy/Jenks Consultants, 200 S.W. Market St., Suite 500, Portland, OR 97201

Sponsor's Study Monitor: Dr. Taku Fuji

Testing Laboratory: Northwestern Aquatic Sciences, P.O. Box 1437, Newport, Oregon 97365.

Test Location: Newport Laboratory.

Laboratory's Study Personnel: M.S. Redmond, M.S., Proj. Mngr./ Study Dir.; L.K. Nemeth, B.A., M.B.A., QA Officer; R.S. Caldwell, Ph.D., Sr. Aq. Toxicol.; G.J. Irissarri, B.S., Aq. Toxicol.; G.A. Buhler, B.S., Aq. Toxicol.; W.T. Montgomery, A.A., Sr. Tech.; S. J. Gage, B.A., Tech.; G. Hutchinson, B.S., Tech.

Study Schedule:

Test Beginning: 2-23-06, 1055 hrs.

Test Ending: 3-15-06, 1000 hrs.

Disposition of Study Records: All specimens, raw data, reports and other study records are stored according to Good Laboratory Practice regulations at Northwestern Aquatic Sciences, 3814 Yaquina Bay Rd., Newport, OR 97365.

Good Laboratory Practices: The test was conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

Statement of Quality Assurance: The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with the protocol and standard operating procedures. This report is an accurate reflection of the raw data.

## TEST MATERIAL

Control Sediment: Control sediment (NAS Sample #0438G) was collected from the *Eohaustorius estuarius* amphipod collection site in lower Yaquina Bay, Oregon, on 2-14-06. Interstitial salinity was 5.0 ‰. The sediment was sieved through a 0.5-mm stainless steel screen and stored at 4°C in the dark.

Test Sediments: Five test sediments and two reference sediments were tested. Details follow:

NAS Sample No.	0421G	0422G	0423G	0424G
Sample Description	SD-100	SD-101	SD-102	SD-103
Collection Date	1-26-06	1-26-06	1-26-06	1-26-06
Receipt Date	1-27-06	1-27-06	1-27-06	1-27-06
Interstitial Salinity (‰)	1.5	3.0	1.0	4.5
NAS Sample No.	0425G	0426G	0427G	
Sample Description	SD-104	REF-EBB	REF-YB	
Collection Date	1-26-06	1-26-06	1-26-06	
Receipt Date	1-27-06	1-27-06	1-27-06	
Interstitial Salinity (‰)	5.0	5.0	7.0	

Storage: Upon receipt, sample containers were completely full (no headspace). Samples were stored at 4°C in the dark.

Treatments: The samples were homogenized by mixing with stainless steel implements.

**TEST WATER**

Source: Yaquina Bay, Oregon

Date(s) of Collection: 2-21-06

Water Quality: Salinity 28.0‰, pH 8.0

Pretreatment: Filtered to  $\leq 0.40 \mu\text{m}$ , salinity-adjusted with MilliQ® deionized water, aerated.

**TEST ORGANISMS**

Species: *Neanthes arenaceodentata*, marine polychaete worm

Age: 2-3 week post-emergence juveniles

Initial wt.: 0.74 mg

Source: Laboratory cultures at the Department of Biology, California State University, Long Beach, California.

Worms were received on 2-21-06.

Acclimation: Average conditions during the two days prior to testing were: temperature,  $18.3 \pm 3.9^\circ\text{C}$ ; pH,  $7.6 \pm 0.5$ ; salinity,  $30.8 \pm 2.8 \text{‰}$ ; dissolved oxygen,  $7.4 \pm 0.5 \text{ mg/L}$ .

**TEST PROCEDURES AND CONDITIONS**

The following is an abbreviated statement of the test procedures and a statement of the test conditions actually employed. See the test protocol (Appendix I) for a more detailed description of the test procedures used in this study.

Test Chambers: 1 L covered borosilicate glass beakers.

Test Volumes: 175 ml of test, reference, or control sediment; 950 ml total volume.

Replicates/Treatment: 5 (plus one water-quality replicate)

Sediment Salinity Adjustment: After sediment and overlying water were added to beakers on test day -1, sediment was stirred with the overlying water and allowed to settle overnight with aeration.

Organisms/Treatment: 25 (5/replicate)

Water Volume Changes: One third of the seawater in each beaker was replaced every third day.

Aeration: Provided using a 1-ml glass pipette with the tip 3-4 cm below the water surface. Air was bubbled at a low rate (150-300 ml/min) so as not to disturb the sediment surface.

Feeding: Animals were fed 40 mg TetraMarine® per beaker every other day.

Acceptance Criteria: Results are valid if mean control survival is at least 90%. DMMP and SMS require control sediment mortality of  $\leq 10\%$  and a growth rate of  $> 0.38 \text{ mg/individual/day}$ .

Performance Criteria: For DMMP and SMS testing, the reference sediment mortality should be  $\leq 20\%$  with a growth rate of  $\geq 80\%$  that of the negative control sediment.

Effects Criteria: 1) survival after 20 days, 2) average individual biomass, and 3) average individual growth rate. Death is defined as no visible appendage movement or response to tactile stimulation. Missing worms are considered dead.

Water Quality and Other Test Conditions: The temperature, dissolved oxygen, salinity, and pH were measured in the overlying water of one replicate water quality beaker on test days 0 and 20, and on test days 3, 6, 9, 12, 15, and 18 prior to test solution renewal. Total dissolved sulfide and total ammonia-N were measured in the overlying water of the water quality replicate test chamber on days 0 and 20. Total ammonia-N was also measured in the overlying water of the water quality replicate test chamber on day 3 prior to water renewal. Total soluble sulfide and total ammonia-N were measured using Hach reagents based on the methylene blue (EPA Method 376.2) and salicylate (Clin. Chim. Acta 14:403, 1996) colorimetric methods, respectively; samples were not distilled prior to analysis. Un-ionized ammonia-N was computed using "Un-ionized Ammonia Calculator", v1.0 (Dr. Landon Ross, Florida Department of Environmental Protection). The photoperiod was constant light.

**DATA ANALYSIS METHODS**

Percent survival, individual biomass, and individual growth rate at the end of the test were determined from the final observations according to the formulas:

Percent survival =  $100 \times (\text{no. of surviving worms} / \text{initial number of worms})$   
 Individual biomass = total dry wt. of worms / number of surviving worms weighed  
 Individual growth rate = (individual biomass - the initial dry wt.) / the number of test days

Control and treatment means and standard deviations for the biological endpoints described above and for water quality data were computed using Microsoft EXCEL 2000. The software used for statistical comparisons was BioStat (Beta v.4.1 (EXCEL)) bioassay software developed by the U.S. Army Corps of Engineers, Seattle District. Mean individual growth rate in each test sediment was compared against that against that in the reference sediment. Following determination of normality and homogeneity of variances, a one-tailed Student T-test, Approximate T-test, One-sample T-test, Mann Whitney test, or Rankit Analysis was conducted at the 0.05 level of significance.

### PROTOCOL DEVIATIONS

1. Mortality in the reference toxicant test initiated on the same day as the sediment test was inadvertently not checked on day 4. Therefore, a second reference toxicant test was immediately initiated with worms from the same population. The repeat test was thus initiated five days after the sediment test, but was still concurrent with it.
2. Several salinity measurements were below the protocol-specified limits of  $28.0 \pm 2.0$  ‰ (minimum 25.0 ‰). This was due to the low salinity of the test and control sediments and the salinity adjustment procedure.

### REFERENCE TOXICANT TEST

The reference toxicant test is a standard multi-concentration toxicity test using cadmium as  $\text{CdCl}_2 \cdot 2\frac{1}{2}\text{H}_2\text{O}$ , to evaluate the performance of the test organisms used in the sediment toxicity test. The performance is evaluated by comparing the results of this test with historical results obtained at the laboratory. A summary of the reference toxicant test result is given below. The reference toxicant test raw data are found in Appendix II.

Test No.: 999-2091

Reference Toxicant and Source:  $\text{CdCl}_2 \cdot 2\frac{1}{2}\text{H}_2\text{O}$ , Aldrich Lot No. 12422KB, 1.0 mg/ml stock prepared 7-13-04

Test Date: 2-28-06

Dilution Water Used: Yaquina Bay, Oregon, seawater; 28.0 ‰

Result: The 96-hr LC50 was 8.84 mg Cd/L. This result is within the laboratory's control chart warning limits (4.86 – 11.0 mg Cd/L).

### RESULTS AND DISCUSSION

Observations of water quality parameters during the test are summarized in Table 1. Individual water quality measurements are located in the raw data (Appendix II).

Except as noted above, all measurements of standard water quality parameters were within protocol specified ranges (Table 1). Sulfides were not detected in the overlying bioassay water (detection limit 0.1 mg/L). Total ammonia-N ranged from 0.2 mg/L to 7.5 mg/L (maximum un-ionized ammonia 0.012 mg/L).

Table 2 shows the effects of test sediment exposures on survival and growth of *Neanthes*. The test met the acceptability criterion ( $\geq 90\%$ ) for control survival; mean survival in the control was 100%. The individual growth rate in the controls averaged 1.03 mg/day/worm. This meets the DMMP recommendation for a minimum growth rate of 0.72 mg/day/worm for *Neanthes*. The average initial weight of worms was 0.74 mg, within the recommended range of 0.5 - 1.0 mg. The reference sediments included in the study met the performance standard requirement that mortality in the reference sediment should be  $\leq 20\%$ ; mortality in both REF-EBB and REF-YB was 0.0%. The growth rate criterion was met for one of the reference sediments. According to DMMP criteria, the mean individual growth rate in the reference sediment should be  $\geq 80\%$  of the mean individual growth rate in the control sediment. Control growth rate was 1.03 mg/day/worm. Growth rate in reference sediment REF-EBB was 0.79 mg/day/worm, and that in REF-YB was 1.09 mg/day/worm, corresponding to 76.7% and 106% of the control growth rate, respectively. REF-EBB was used for statistical comparisons, by direction of the client.

The test control acceptance and reference sediment performance criteria for survival were met, as was the growth criterion for the control. Positive control performance was within the laboratory's acceptance limits. However, the growth criterion for the selected reference sediment was not met. It is concluded, therefore, that the test has developed provisionally acceptable data for use in making management decisions.

None of the test sediments showed significantly decreased individual growth rate compared with reference sediment REF-EBB (Table 2).

Interpretation was based on guidelines from the "Dredged Material Evaluation and Disposal Procedures, A User's Manual for the Puget Sound Dredged Disposal Analysis (PSDDA) Program," February 2000 (U.S. Army Corps of Engineers, Seattle District; U.S. Environmental Protection Agency, Region 10, Washington Department of Natural Resources, Washington Department of Ecology). If the mean individual growth rate of a test sediment is <80% of the mean negative control growth rate, and <70% (dispersive) or <50% (nondispersive) of the mean reference sediment growth rate, and statistically different ( $\alpha = 0.05$ ) from the reference sediment, it fails under the single-hit rule. None of the test sediments failed the single-hit rule under these guidelines (Table 3).

#### STUDY APPROVAL

Michele S. Redmond 6-13-06  
Project Manager/ Study Director Date

Julie R. Fiore for  
Linda Nemeth 6-13-06  
Quality Assurance Unit Date

Richard A. Caldwell 6/13/06  
Laboratory Director Date

Table 1. Summary of overlying water quality conditions during tests of the polychaete, *Neanthes arenaceodentata*, exposed to marine sediments.

Parameter	Mean $\pm$ SD	Minimum	Maximum	N
Temperature ( $^{\circ}$ C)	19.9 $\pm$ 0.5	19.0	21.0	64
pH	7.7 $\pm$ 0.1	7.3	7.9	64
Salinity (‰)	28.2 $\pm$ 1.5	25.0	30.0	64
Dissolved Oxygen (mg/L)	6.8 $\pm$ 0.4	5.4	7.4	64
Dissolved Sulfide (mg/L)	---	<0.1	<0.1	16
Total Ammonia-N (mg/L)	---	0.2	7.5	24
Un-ionized Ammonia (mg/L)	---	0.004	0.012	24

Table 2. Means and standard deviations (n=5) of percent survival, individual dry weight, and individual growth rate of *Neanthes* exposed for 20 days to marine sediments. An "\*" indicates that the percent individual growth rate in a test sediment was significantly lower than that in reference sediment REF-EBB (p<0.05). Only the individual growth rate was compared statistically.

Sample description	Percent Survival (20-days)	Individual dry wt. (mg)	Individual growth rate (mg/day/worm)
Control (NAS #0438G)	100.0 $\pm$ 0.0	21.3 $\pm$ 5.2	1.03 $\pm$ 0.26
REF-EBB (NAS #0426G) <sup>1</sup>	100.0 $\pm$ 0.0	16.5 $\pm$ 2.3	0.79 $\pm$ 0.12
REF-YB (NAS #0427G) <sup>1</sup>	100.0 $\pm$ 0.0	22.6 $\pm$ 3.3	1.09 $\pm$ 0.17
SD-100 (NAS #0421G)	100.0 $\pm$ 0.0	15.6 $\pm$ 1.6	0.74 $\pm$ 0.08
SD-101 (NAS #0422G)	100.0 $\pm$ 0.0	16.5 $\pm$ 2.3	0.79 $\pm$ 0.12
SD-102 (NAS #0423G)	96.0 $\pm$ 8.9	17.3 $\pm$ 2.2	0.83 $\pm$ 0.11
SD-103 (NAS #0424G)	100.0 $\pm$ 0.0	15.3 $\pm$ 3.3	0.73 $\pm$ 0.17
SD-104 (NAS #0425G)	100.0 $\pm$ 0.0	16.8 $\pm$ 2.2	0.80 $\pm$ 0.11

<sup>1</sup> REF-EBB was used as the reference sediment; REF-YB was not used for statistical comparisons.



Table 3. Single-hit criteria interpretation of *Neanthes* juvenile infaunal growth test data. REF-EBB was used as the reference sediment.

Sample description	Individual growth rate (mg/day)	Significantly different from REF-EBB at $\alpha = 0.05$ ?	Percent of negative control	Percent of REF-EBB value	Failure under 1-hit dispersive rule?	Failure under 1-hit nondispersive rule?
Control (NAS #0438G)	$1.03 \pm 0.26$	---	---	---	---	---
REF-EBB (NAS #0426G) <sup>1</sup>	$0.79 \pm 0.12$	---	76.7	---	---	---
REF-YB (NAS #0427G) <sup>1</sup>	$1.09 \pm 0.17$	---	106	---	---	---
SD-100 (NAS #0421G)	$0.74 \pm 0.08$	NO	71.8	93.7	NO	NO
SD-101 (NAS #0422G)	$0.79 \pm 0.12$	NO	76.7	100	NO	NO
SD-102 (NAS #0423G)	$0.83 \pm 0.11$	NO	80.6	105	NO	NO
SD-103 (NAS #0424G)	$0.73 \pm 0.17$	NO	70.9	92.4	NO	NO
SD-104 (NAS #0425G)	$0.80 \pm 0.11$	NO	77.7	101	NO	NO

<sup>1</sup> REF-EBB was used as the reference sediment; REF-YB was not used for statistical comparisons.

**APPENDIX I**  
**PROTOCOL**

TEST PROTOCOL

**JUVENILE POLYCHAETE, *NEANTHES ARENACEODENTATA*,  
20-DAY SOLID PHASE SEDIMENT BIOASSAY**

1. INTRODUCTION

- 1.1 Purpose of Study: The purpose of this study is to identify marine sediments that are toxic to a marine polychaete worm. .
- 1.2 Summary of Method: The 20-day static renewal test is performed using laboratory-cultured, 2-3 week post-emergence juvenile worms purchased from a supplier. Test sediments are placed in the bottom of 1-liter glass beakers used as test vessels which are then filled with clean seawater. Five replicate containers for each test sediment, reference sediment, and the control sediment, each containing 5 test organisms, are employed. During test setup, three subsamples of five worms each are randomly selected to provide an estimate of initial biomass. During the exposure period, each chamber is provided with 40 mg of food on an every-other-day basis. Every third day, one-third of the seawater in each chamber is exchanged with fresh seawater. Survival and growth are the response criteria used. The mean and standard deviation for each treatment and test endpoint are given in the final report. Between-treatment statistical comparisons may be made, where each treatment is compared to the control and/or reference sediment. This protocol is based on PSEP (1995) guidelines, PSDDA (PSDDA 1989, U.S. ACOE et al. 2000) modifications, and SMS guidelines (WDOE 2003).

2. STUDY MANAGEMENT

2.1 Sponsor's Name and Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2.2 Sponsor's Study Monitor:

\_\_\_\_\_

2.3 Name of Testing Laboratory:

Northwestern Aquatic Sciences  
3814 Yaquina Bay Road, P.O. Box 1437  
Newport, OR 97365.

2.4 Test Location: Newport Laboratory

2.5 Laboratory's Personnel to be Assigned to the Study:

Project Manager/Technical Director: \_\_\_\_\_  
Qual. Assurance Officer: \_\_\_\_\_  
Aquatic Toxicologist: \_\_\_\_\_  
Aquatic Toxicologist: \_\_\_\_\_

2.6 Proposed Testing Schedule: Tests should begin within 2 weeks (8 weeks with samples under nitrogen for PSDDA or SMS) of sample collection. Reference toxicant test to be run concurrently.

2.7 Good Laboratory Practices: The test is conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

3. TEST MATERIAL

The test materials are marine or estuarine sediments. The collected sediments are placed in a suitable container for shipping and storage. The preferred container is a solvent and acid cleaned 1 L glass jar fitted with a TFE-lined screw cap. The jars are filled completely so that there is no air space. At the laboratory, the samples may be stored at 4°C in the dark in the original sealed containers for up to 2 weeks (8 weeks with no headspace or with samples under nitrogen for PSDDA or SMS) prior to testing. The negative control sediment is from a clean site. In addition, one or more reference sediments, clean sediments with physical characteristics similar to the test sediments, may also be employed.

4. TEST WATER

Test water is filtered Yaquina Bay seawater adjusted to a salinity of 28 ppt. The water is pumped from Yaquina Bay into a 6000 gal seasoned fiberglass reservoir from which it is supplied under pump pressure to the laboratory. Filtration is accomplished using a sand filter followed by 5 µm, 1µm, and 0.40µm cartridge filters. An alternative seawater supply of similar quality may be used.

5. TEST ORGANISMS

5.1 Species: *Neanthes arenaceodentata*

5.2 Source: *Neanthes* are obtained from laboratory cultures. California State University, Long Beach, Dept. of Biology is a source for purchasing these worms.

5.3 Laboratory Handling: Worms are received from the supplier in plastic bags containing seawater and algae (*Enteromorpha*). Upon receipt, water quality data are taken on 1 or 2 bags and all bags with worms are then placed in holding aquaria containing seawater at  $20 \pm 1^\circ\text{C}$ , and the salinity is adjusted to  $28 \pm 2$  ppt. Worms are generally maintained for 1-2 days prior to use in tests, but may be held longer if water changes are provided. Gentle aeration is supplied to the holding aquaria. During the holding period, organisms are fed ground TetraMarine® (approximately 0.1 g per 200-300 worms) on an every-other-day basis. If the food is not being consumed, feeding should be reduced. No water changes are required if holding time is less than 1 week.

5.4 Age at Study Initiation: 2-3 week post-emergence juveniles (0.5-1.0 mg dry weight).

6. DESCRIPTION OF TEST SYSTEM

6.1 Test Chambers and Environmental Control: Test chambers used in the toxicity test are 1000 ml glass beakers. The beakers are covered to minimize contamination and evaporation of seawater or loss of volatile compounds. Test chambers are maintained at constant temperature by partial immersion in a temperature-controlled water bath or by placement in a temperature-controlled room. Minimal aeration is supplied through a glass pipet. The aeration rate should be 150 - 300 mL/minute or approximately 100 bubbles per minute). The test is performed under continuous illumination, using ambient laboratory lighting of low to moderate intensity. SMS may require UV light for PAH-contaminated intertidal sediments.

6.2 Cleaning: All laboratory glassware, including test chambers, is cleaned as described in EPA/600/4-90/027F. New glassware and test systems are soaked 15 minutes in tap water and scrubbed with detergent (or cleaned in an automatic dishwasher); rinsed twice with tap water; carefully rinsed once with fresh, dilute (10%, V:V) hydrochloric or nitric acid to remove scale, metals, and bases; rinsed twice with deionized water; rinsed once with acetone to remove organic compounds (using a fume hood or canopy); and rinsed three times more with deionized water. Test systems and chambers are rinsed again with dilution water just before use.

7. EXPERIMENTAL DESIGN AND TEST PROCEDURES

7.1 Experimental Design: An experimental design is used consisting of exposure of test organisms to a number of test sediments, one or more reference sediments, and a control sediment. Each treatment consists of five replicate test chambers each containing 5 animals. An additional replicate containing 5 test organisms is used for daily water quality measurements. More replicates, with or without test organisms as appropriate, may be employed for periodic interstitial water quality measurements. Blind, random testing is used.

- 7.2 Preparation of Test Sediments: The interstitial salinity of the test, reference, and control sediments is measured. If initial interstitial salinities are not  $\geq 20$  ppt, the interstitial salinities must be adjusted as specified in the PSEP (1995) protocols.

Certain projects may require purging of excess ammonia from sediment interstitial water. PSDDA and SMS allow purging to be considered when interstitial total ammonia concentrations exceed specified limits. However, purging is allowed only by agency permission, so the decision to purge should be made by the client. Testing of purged sediments may require concurrent testing of the same sediments unpurged.

If no salinity adjustment or purging is done, sediments are used without further treatment. Each test sediment is mixed thoroughly using a non-contaminating implement, then an aliquot (175 ml) sufficient to make a 2-cm-deep layer is added to each test beaker, and the surface is smoothed. Bubbles are removed from the sediment by gently tapping each beaker against the palm of the hand. Seawater at the test temperature and salinity is carefully added into the beaker to the 750 ml mark utilizing a water dispersal technique to avoid suspending the sediment. The beakers are then placed into the water bath or constant-temperature room and covered with watchglasses. An air delivery pipet is inserted into each beaker under the watchglass. Overhead lights provide constant illumination. Water in the test beakers is aerated without disturbing the sediments. The test system is then allowed to temperature equilibrate overnight.

- 7.3 Beginning the Test: More worms than are needed for the bioassay are transferred to a shallow glass dish containing seawater of the test salinity and temperature. Worms are impartially distributed to a series of seawater-filled cups, each holding 5 worms. Enough cups for the test plus three additional cups are prepared. One container of 5 worms is randomly added to each replicate. Three of the cups containing worms are randomly selected and set aside. Worms from these cups are used to estimate initial total biomass. To determine initial total biomass, worms from these three cups are quickly rinsed with deionized water, placed on a preweighed aluminum pan, dried at  $50^{\circ}\text{C}$  to a constant weight, and weighed to the nearest 0.1 mg.

Once worms are added to a replicate, the number of animals that do not burrow into the test sediment within one hour is recorded. Worms not burrowed are removed and replaced with healthy worms, unless the observer believes the failure to burrow is a response to toxic material. Following addition of worms to the test chambers, additional water is added to achieve a final volume of 950 ml.

TetraMarine<sup>®</sup> is provided to each beaker (40 mg/beaker). The food is preweighed into plastic cups, wetted with bioassay test water, and rinsed into the test beakers.

- 7.4 Effects Criteria: Effects criteria are 1) survival after 20 days, 2) total biomass (dry weight), 3) average individual biomass (total biomass divided by the number of surviving worms), and 4) average individual growth rate.
- 7.5 Test Conditions: Test containers are maintained at a constant  $20 \pm 1^{\circ}\text{C}$ . The test salinity is  $28 \pm 2$  ppt. The dissolved oxygen concentration in each test container must be greater than 60% saturation (PSEP 1995) or 4.0 mg/L (PSDDA) throughout the 20-day test. Each beaker is supplied with oil-free compressed air provided at a rate of approximately 100 bubbles per minute through disposable glass pipettes. Each beaker is covered by a watchglass to minimize evaporation and the possibility of cross contamination between beakers. The test is conducted under constant illumination of moderate to low intensity.

During the 20-day exposure, one-third of the seawater in each beaker is replaced every third day. Prior to seawater replacement, water quality measurements are determined for one replicate test chamber for each test, reference, and control sediment. Water replacement is achieved by siphoning one-third of the volume of test water, then replacing it with fresh  $28 \pm 2$  ppt test water that has been maintained at  $20 \pm 1^{\circ}\text{C}$ . Care should be taken not to disturb the sediments.

- 7.6 Feeding: Animals are fed 40 mg TetraMarine<sup>®</sup> per beaker on an every-other-day basis during the test.

- 7.7 Test Duration, Type and Frequency of Observations, and Methods: The duration of the sediment toxicity test is 20 days. The test chambers are observed daily to ensure that adequate aeration is provided and to note the general status of each chamber. The temperature of the environmental chamber should also be monitored daily. The type and frequency of observations to be made are summarized as follows:

TYPE OF OBSERVATION	TIMES OF OBSERVATION
<b>Biological Data</b>	
Survival	end of test
Biomass	end of test
<b>Physical and Chemical Data</b>	
Sediment interstitial salinity	at test beginning (bulk sediments) & end
Salinity, dissolved oxygen, pH, and temperature of overlying water (one replicate only)	day 0, day 20 and prior to partial replacement of test water every third day
Temperature in temperature beaker	daily
Ammonia and sulfides in overlying water (one replicate)	at test beginning & end; for PSDDA and SMS, on day 3 prior to seawater replacement *
Ammonia, sulfide, pH & salinity in interstitial water (optional)	for PSDDA and SMS, ammonia, pH, & salinity in bulk sediments; additional measurements as requested by client
Check air and lights	daily

\*PSEP (1995) recommends ammonia-N and sulfide monitoring prior to the first and second water renewals when initial monitoring reveals >0.7 mg/L un-ionized ammonia or >5.0 mg/L sulfides.

Following the exposure period, worms from each chamber are removed from the test sediment by gently sieving the sediment through a 0.5 mm screen. Worms often are in their tubes and can be removed by gently prodding either end of the tube with a fine-point paintbrush. The number of surviving worms is recorded. Surviving worms are placed in a container of clean seawater until all chambers have been sieved. Then worms from each chamber are quickly rinsed with deionized water, placed on a pre-weighed aluminum pan, dried at 50°C to a constant weight, and weighed to the nearest 0.1 mg.

Dissolved oxygen is measured directly in test bakers using a polarographic oxygen probe calibrated according to the manufacturer's recommendations. The pH is measured using a properly calibrated pH meter with scale divisions of 0.1 pH units. Temperature is measured using a calibrated mercury thermometer or a telethermometer. Salinity is measured using a refractometer. The method used for the measurement of total ammonia-N in the overlying water and sediment porewater from sediment bioassays is based on the salicylate colorimetric method of Hach Chemical Co. and was adapted from Clin. Chim. Acta., 14: 403 (1966). The method used for the measurement of dissolved sulfide in the overlying water and sediment porewater in marine sediment bioassays is the methylene blue colorimetric method based on SM 4500-S<sup>2-</sup> (Standard Methods 1995 [19<sup>th</sup> edition]). Any observed changes in sediment color or the formation of a sediment discontinuity layer is also recorded.

- 7.8 Criteria of Test Acceptance: For the test to be considered acceptable, mean mortality of organisms in the control treatment at the end of the test should be ≤10%
- 7.9 Performance criteria: For PSDDA and SMS, control sediment should have mean mortality ≤10% and target mean growth rate >0.72 mg/worm/day (failure if growth rate <0.38 mg/worm/day). Initial weight of worms should be 0.5-1.0 mg (failure if <0.25 mg). Reference sediment should have mean mortality ≤20% and mean growth rate ≥80% of the control sediment.
- 7.10 Reference Toxicant test: A routine reference toxicant test is run concurrently with each sediment test. This is normally a 96-hr test with cadmium chloride. PSDDA and SMS also require a water-only ammonia test when ammonia concentrations exceed specified limits.

8. DATA ANALYSIS

The mean and standard deviation are calculated for each endpoint employed (e.g. 20-day survival, 20-day total biomass, 20-day average individual biomass, and average individual growth rate) and for each treatment (i.e. test sediment). Between-treatment comparisons may be made using a Student's t-test, Wilcoxon's Two-Sample test, Mann-Whitney U test, or Rankit Analysis, where each treatment is compared to the control or the reference sediment. An arcsine-square root transformation of proportional data, and tests for normality and heterogeneity of variances, are performed prior to statistical comparisons.

9. REPORTING

A report of the test results must include the following information: name and identification of the test; the investigator and laboratory; information on the test, reference, and control sediments including the initial and final interstitial salinities; information on the source of seawater used; detailed information about the test organisms including acclimation conditions; a description of the experimental design and test chambers and other test conditions including water quality; information about any aeration that may have been required; definition of the effect criteria and other observations; unusual responses, if any, in the control treatment; 20-day survival in each exposure chamber and the mean and standard deviation for each treatment; initial total biomass (dry weight) for three groups of five worms; 20-day total biomass (dry weight) in each exposure chamber and the mean and standard deviation for each treatment; 20-day average individual biomass (dry weight) in each exposure chamber and the mean and standard deviation for each treatment; average individual growth rate in each exposure chamber and the mean and standard deviation for each treatment; 96-hour LC50 with reference toxicant; a description of data analysis methods employed and documentation of statistical test results; any unusual information about the test or deviations from procedures.

10. STUDY DESIGN ALTERATION

Amendments made to the protocol must be approved by the sponsor and study director and should include a description of the change, the reason for the change, the date the change took effect, and the dated signatures of the study director and sponsor. Any deviations in the protocol must be described and recorded in the study raw data.

11. REFERENCED PROCEDURES

Johns, D.M., T.C. Ginn, and D.R. Reish. 1990. Protocol for juvenile Neanthes sediment bioassay. Prepared for U.S. Env. Prot. Agency, Region 10 -Office of Puget Sound, Seattle, WA, 17 pp.

Puget Sound Dredged Disposal Analysis (PSDDA). 1989. Management plan report - unconfined open-water disposal of dredged material, Phase II - (north and south Puget Sound). Puget Sound Dredged Disposal Analysis, Army Corps of Engineers, Seattle, WA. (and other modifications made through the PSDDA process and Sediment Management Annual Review Meetings).

Puget Sound Estuary Program. 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Prepared for U.S. Env. Prot. Agency, Region 10, Office of Puget Sound, Seattle, WA, and Puget Sound Water Quality Authority, Olympia, WA.

Snedecor, G.W. and W.G. Cochran. 1967. Statistical methods. Sixth Ed., The Iowa State Univ. Press. Ames, Iowa., 593 pp.

U.S. Army Corps of Engineers, Seattle District; U.S. EPA, Region 10; Washington Department of Natural Resources; Washington Department of Ecology. 2000. Dredged material evaluation and disposal procedures: a user's manual for the dredged disposal analysis (PSDDA) program.

Washington State Department of Ecology. 2003. Sediment sampling and analysis plan appendix. Publication no. 03-09-043, WDOE, Olympia, WA.

Weber, C.I. (Ed.) 1991. Methods for measuring the acute toxicity of effluents to freshwater and marine organisms (fourth edition). EPA/600/4-90/027.

12. APPROVALS

\_\_\_\_\_  
Name Date for \_\_\_\_\_

\_\_\_\_\_  
Name Date for NORTHWESTERN AQUATIC SCIENCES



## **APPENDIX II**

### **RAW DATA**

**TEST DESCRIPTION, MONITORING, AND RESULTS  
BENCHSHEETS**

Test No. 738-2

Client

Kennedy/Jenks

Investigator

renewed  
P.P. 1-41  
P.P. M.R.

6-13-06

## STUDY MANAGEMENT

Client: Kennedy/Jenks Consultants, 200 S.W. Market St., Suite 500, Portland, OR 97201

Client's Study Monitor: Dr. Taku Fuji

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir.

M.S. Redmond M.R.

QA Officer

L.K. Nemeth

1. Bill Montgomery M
3. Susan Goff J
5. R.S. Caldwell
- 7.

2. GAB. H. Lee M
4. Greg Hutchinson GH
6. G.J. IRISSAPPI GJ
- 8.

Study Schedule:

Test Beginning: 2-23-06 10:55

Test Ending: 3-15-06 10:00

## TEST MATERIAL

General description (see sample logbook/chain-of-custody for details):

NAS Sample No.:	0421G	0422G	0423G	0424G	0425G
Description:	SD-100	SD-101	SD-102	SD-103	SD-104
Collection Date:	1/26/06	1/26/06	1/26/06	1/26/06	1/26/06
Receipt Date:	1/27/06	1/27/06	1/27/06	1/27/06	1/27/06
Inters. Salinity (ppt):	1.5	3.0	1.0	4.5	5.0

NAS Sample No.:	0426G	0427G			
Description:	REF-EBB	REF-YB			
Collection Date:	1/26/06	1/26/06			
Receipt Date:	1/27/06	1/27/06			
Inters. Salinity (ppt):	5.0	7.0			

NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
Inters. Salinity (ppt):					

NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
Inters. Salinity (ppt):					

Investigator \_\_\_\_\_

## SEDIMENT DESCRIPTIONS -- SUPPLEMENTAL NOTES

[illegible]

## NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator \_\_\_\_\_

## TEST WATER

Source: Yaquina Bay, Oregon, sea water

Date(s) of Collection: 2-21-06 Salinity (ppt) 28.0 pH 8.0

Treatments: filtered to 0.4  $\mu$ m, salinity-adjusted with MilliQ deionized water, aerated

## TEST ORGANISMS

Species: Neanthes arenaceodentata

Date received: 2-21-06

Source: Dept. of Biology, CA State University, Long Beach, CA

## Acclimation Data:

Date	Temp. (deg.C)	pH	Sal (ppt)	DO (mg/L)	Feeding		Water changes	Comments
					amount	description		
2-21-06	13.8	7.0	34.0	7.6	0.19/tank	Tetramarin	yes	receiving water
2-22-06	20.4	7.9	29.5	6.8			yes	
2-23-06	20.7	7.8	29.0	7.8	0.19/tank	Tetramarin	yes	
Mean	18.3	7.6	30.8	7.4				
S.D.	3.9	0.5	2.8	0.5				
(N)	3	3	3	3				

Photoperiod during acclimation: not recorded

## TEST PROCEDURES AND CONDITIONS

Test chambers: 1 L glass beakers covered with watchglasses

Test volumes: 175 ml of test sediment; 950 ml total volume

Replicates/treatment: (5) 5 Organisms/treatment: (25) 25

Test water changes: Every third day beginning with day 3

Aeration: yes, 3 cm below water surface

Beaker placement: Total randomization

Feeding: every other day beginning with day zero

Photoperiod: Constant light

Test temperature (deg.C): 20.0  $\pm$  1.0

Salinity: 28  $\pm$  2 ppt

Additional replicates included for water quality purposes (indicate numbers of each that apply):

1 Water quality beaker (with test organisms; may also be day 20 sacrificial beaker)

\_\_\_\_\_ Day zero sacrificial beaker (no test organisms)

\_\_\_\_\_ Day \_\_\_\_\_ sacrificial beaker(s) (with test organisms)

## Control Sediment:

Source: Yaquina Bay, Oregon

Date collected: 2-14-06 Interstitial salinity: 5.0‰

Sieved through 0.5 -mm screen

Storage: 4°C in the dark NAS# 0438G

## MISCELLANEOUS NOTES

Light intensity measurements:

Date 2-24-06 Location in room watchglass, beaker #20 foot-candles 24.4

Test No. 738-1

Client

Kennedy/Jenks

Investigator

Test conducted in (circle one): room 1 room 2 trailer water bath other: \_\_\_\_\_

Randomization chart:

*lead*

3	6				45	48			
2	5	→	→	→	44	47			
1	4				43	46			

*door*  
→

Randomization chart:


Randomization chart:


Randomization chart:


## TEST SCHEDULE SUMMARY

Date	2-23-06	2-24-06	2-25-06	2-26-06	2-27-06	2-28-06	3-1-06	3-2-06	3-3-06	3-4-06	3-5-06	3-6-06	3-7-06	3-8-06	3-9-06	3-10-06	3-11-06	3-12-06	3-13-06	3-14-06	3-15-06
Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Feed	x		x		x		x		x		x		x		x		x		x		x
Record WQ	x			x			x			x			x			x			x		x
Change water				x			x			x			x			x			x		
Overlying NH <sub>4</sub> S	x			NH <sub>3</sub>																	x
Initials	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>	<i>ms</i>
Porewater NH <sub>4</sub> , ppt, pH																					ppt only
Initials																					

Test No. 738-2

Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 0 (2 123 106) mm/mRTemperature beaker: 21.0 deg.Cair okay? (if not, details in comments below) All OKoverlying ammonia sampled? yes  
(days 0,3,20)water change? (every third day) —overlying sulfide sampled? yes  
(days 0, 20)fed? (every second day) yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. not buried	Comments
1					0	
2					0	
* 3	20.7	7.7	25.0	6.6	0	
4					0	
* 5	20.8	7.7	26.0	7.0	0	
6					0	
7					0	
8					0	
9					0	
10					0	
* 11	21.0	7.7	25.5	7.0	0	
12					0	
13					0	
14					0	
15					0	
16					0	
17					0	
18					0	
19					0	
20					0	
21					0	
22					0	
23					0	
24					0	
25					0	
* 26	20.9	7.9	26.0	6.9	0	
27					0	
28					0	
29					0	
30					0	
* 31	21.0	7.7	26.0	6.9	0	
32					0	
* 33	20.8	7.9	26.0	6.9	0	
34					0	
35					0	
36					0	
37					0	
38					0	
39					0	
40					0	

\* Water quality beakers

Test No. 738-2      Client      Kennedy/Jenks      Investigator

Day 0 (2/23/06) *WJH/mj*

Temperature beaker:                      deg.C

[illegible]

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Test No. 738-2

Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 1 (2/24/06) MB

Temperature beaker: 20.6 deg.C

air okay? (if not, details in comments below) yes

water change? (every third day) 1

fed? (every second day)                     

[illegible]

Day 2 (2/25/02) JB/mkr

Temperature beaker: 20.6 deg.C

air okay? (if not, details in comments below) yes

water change? (every third day) 1

fed? (every second day) yes

[illegible]

Test No. 738-2

Client

Kennedy/Jenks

Investigator

## DAILY RECORD SHEET

Day 3 (2/26/06) MS

Temperature beaker: 20.6 deg.C

air okay? (if not, details in comments below)

Yes

water change? (every third day)

405

fed? (every second day)

9780190238289

overlying NH3 sampled (days 0,3,20)?

yes

~~overlying S sampled (days 0,20)?~~

YMLR

LR  
- 2-13-ck

[illegible]

Day 4 (2/27/06)

Temperature beaker: 20.3 deg.C

air okay? (if not, details in comments below)

yes

water change? (every third day)

1

fed? (every second day)

ye

[illegible]

Investigator \_\_\_\_\_

Day 5 (2/28/06) GH

Temperature beaker: 20.4 deg.C

water change? (every third day) \_\_\_\_\_

fed? (every second day)           

[illegible]

Day 6 (3/1/06)

Temperature beaker: 70.1 deg.C

water change? (every third day) yes

fed? (every second day) yes

[illegible]

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Client

Kennedy/Jenks

Investigator

Temperature beaker: 20.4 deg.C

Day 7 (312 106) *Wm*

Temperature beaker: 20.4 deg.C

air okay? (if not, details in comments below) All OK

water change? (every third day)

fed? (every second day)

[illegible]

Day 8 (3 13 106) with

Temperature beaker: 20.5 deg.C

air okay? (if not, details in comments below) All OK

water change? (every third day)

fed? (every second day)

[illegible]

Test No. 738-2      Client Kennedy/Jenks      Investigator \_\_\_\_\_

## DAILY RECORD SHEET

Day 9 (3/4/06) *sf* Temperature beaker: 19.9 deg.C

air okay? (if not, details in comments below) OK  
 water change? (every third day) yes  
 fed? (every second day) —

[illegible]

Day 10 (3/5/06) W1

Temperature beaker: 20.1 deg.C

air okay? (if not, details in comments below)	OK
water change? (every third day)	-
fed? (every second day)	yes

[illegible]

Test No. 738-2      Client      Kennedy/Jenks      Investigator

## DAILY RECORD SHEET

Day 11 (3 16 106) GH

Temperature beaker: 20.0 deg.C

air okay? (if not, details in comments below) All OK

water change? (every third day) —

fed? (every second day) —

[illegible]

Day 12 (3 17 06) Mon 1/2

Temperature beaker: 19.9 deg.C

air okay? (if not, details in comments below) ALL OK

water change? (every third day) yes

fed? (every second day) Yes

[illegible]

Day 13 (318106) *Wm*

Temperature beaker: 19.6 deg.C

water change? (every third day) \_\_\_\_\_

fed? (every second day) —

[illegible]

Day 14 (3 19 106) 641

Temperature beaker: 19.7 deg.C

water change? (every third day)                     

fed? (every second day) yes

[illegible]

Day 15 (3/10/06) B/worm

air okay? (if not, details in comments below) yes  
 water change? (every third day) yes  
 fed? (every second day) —

[illegible]

Day 16 (3/11/06) MS/48 Temperature beaker: 19.3 deg.C

air okay? (if not, details in comments below) yes  
 water change? (every third day) -  
 fed? (every second day) yes

[illegible]



Temperature beaker: 19.4 deg.C

Test No. 738-2      Client Kennedy/Jenks      Investigator \_\_\_\_\_

## DAILY RECORD SHEET

Day 19 (3/14/06) 6:41

Temperature beaker: 19.7 deg.C

air okay? (if not, details in comments below) All ok

water change? (every third day) —

fed? (every second day) \_\_\_\_\_

[illegible]

Day 20 (3, 15, 106, 64)

Temperature beaker: \_\_\_\_\_ deg.C

air okay? (if not, details in comments below) All ok

water change? (every third day)

fed? (every second day) 

overlying NH<sub>3</sub> sampled (days 0,3,20)? \_\_\_\_\_

overlying S sampled (days 0,20)?

[illegible]

Client

Kennedy/Jenks

Investigator

## DAY 10 TEST TERMINATION SHEET

Beaker No.	Interstitial Salinity	No. of survivors	Initial	Comment
1		5	MUR	
2		5	MUR	
3	32.0			
4		5	WTM	
5	32.0			
6		5	MUR	
7		5	WTM	
8		5	MUR	
9		5	MUR	
10		5	WTM	
11	31.0			
12		5	6J2	
13		5	WTM	
14		5	MUR	
15		5	6J2	
16		5	6J2	
17		5	WTM	
18		5	MUR	
19		5	6J2	
20		5	WTM	
21		5	6J2	
22		5	WTM	
23		5	6J2	
24		5	WTM	
25		5	WTM	
26	30.0			
27		5	VB	
28		5	6J2	
29		5	6J2	
30		5	VB	
31	30.0			
32		5	VB	
33	30.0			MUR 3-27-06**
34		54	WTM	
35		5	VB	
36		5	6J2	
37		5	VB	
38		5	WTM	
39		5	VB	
40		5	6J2	

[illegible]

\* Water quality beakers

\* Water quality beakers  
\*\* When worms were transferred into pans, there were 3 whole worms and 2 half-worms - 4 heads. It is assumed that the broken worm was mistaken for 2 worms at original survival count.

## NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator 

## ZERO-TIME WEIGHING DATA SHEET

Tare: Date 2-22-06 Oven temp (C.) 50 Drying time (hr.) 27 Initials MR  
Standard Weights: 10 mg: 10.005 mg 100mg: 100.011 mgFinal: Date 2-24-06 Oven temp (C.) 50 Drying time (hr.) 22 Initials MR  
Standard Weights: 10 mg: 10.003 100mg: 100.010Equip. used: Oven: Blue m #2 Balance: Sartorius M3P

(Dry overnight at 50 degrees C)

Pan #	Tare wt. (mg)	Total wt. (mg)	#weighed	Comments
4	45.93	49.55	5	
5	46.74	50.25	5	
6	51.92	55.86	5	

## NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator \_\_\_\_\_

## WEIGHING DATA SHEET

Tare: Date 2-23-06 Oven temp (C.) 50 Drying time (hr.) 19 Initials JRF  
 Standard Weights: 10 mg: 10.004 100mg: 100.010

Final #1: Date 3-16-06 Oven temp (C.) 50 Drying time (hr.) 21 Initials JRF  
 Standard Weights: 10 mg: 10.003 100mg: 100.008

Final #2: Date 3-16-06 Oven temp (C.) 50 Drying time (hr.) 1 1/2 Initials JRF  
 Standard Weights: 10 mg: 10.005 100mg: 100.008

Final #3: Date 3-20-06 Oven temp (C.) 50 Drying time (hr.) 2 Initials JRF  
 Standard Weights: 10 mg: 10.007 100mg: 100.012

Equip. used: Oven Blue M #2 Balance Sartorius m3P  
 (Dry overnight at 50 degrees C)

Bkr. #	Pan #	Tare wt. (mg)	Total wt. (mg)			no. weighed	put into pans-initials	Comments
			1	2	3			
1	1	89.66			214.87	5	MJR	
2	2	90.37			175.46	5	MJR	
3	3	—	—	—	—	—	—	
4	4	91.38			173.86	5	MJR	
5	5	—	—	—	—	—	—	
6	6	89.86			232.12	5	MJR	
7	7	94.23			179.65	5	MJR	
8	8	86.71			161.29	5	MJR	
9	9	90.58			163.65	5	MJR	
10	10	87.54			222.25	5	MJR	
11	11	—	—	—	—	—	—	
12	12	93.22			185.27	5	MJR	
13	13	88.92			179.76	5	MJR	
14	14	93.34			157.36	5	MJR	
15	15	96.07			221.04	5	MJR	
16	16	88.45			185.87	5	MJR	
17	17	91.12			159.30	5	MJR	
18	18	84.54			149.00	5	MJR	
19	19	87.49			194.80	5	MJR	
20	20	81.01			168.52	5	MJR	
21	21	92.02			183.72	5	MJR	
22	22	89.04			169.70	5	MJR	
23	23	92.43	197.26		170.05	5	MJR	
24	24	91.86	197.26	196.91	145.87	5	MJR	
25	25	89.96	187.50	187.35	186.67	5	MJR	
26	26	—	—	—	—	—	—	
27	27	91.57	185.95	185.74	184.98	5	MJR	
28	28	84.47	180.43	180.23	179.52	5	MJR	
29	29	85.44	178.12	177.92	177.19	5	MJR	
30	30	77.27	144.39	144.25	143.85	5	MJR	
31	31	—	—	—	—	—	—	
32	32	82.76	169.40	169.22	168.67	5	MJR	
33	33	—	—	—	—	—	—	

\* Water quality beakers

Test No. 738-2

Client

Kennedy/Jenks

Investigator

## WEIGHING DATA SHEET

See page 19 for information on drying times and temperatures, standard weights, etc.

[illegible]

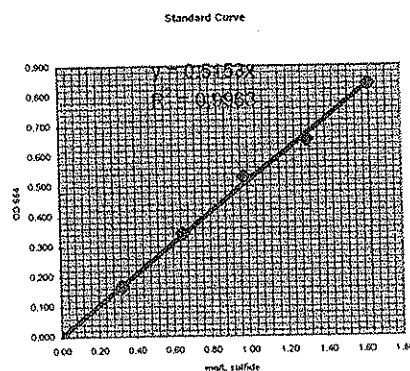
\* Water quality beakers

# Dissolved Sulfide in Water: Computation Worksheet Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	98	100	96
Working Std. Conc. (mg/L):		1.632	

## Result

Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank			
1.0 mL working sulfide std.		0.167	0.33
2.0 mL working sulfide std.		0.342	0.65
3.0 mL working sulfide std.		0.530	0.98
4.0 mL working sulfide std.		0.655	1.31
5.0 mL working sulfide std.		0.838	1.63
3.0 mL spike		0.525	1.02
3.0 mL spike dupl.		0.515	1.00



1.	3	5	0.000	ND
2.	5	5	0.000	ND
3.	11	5	0.004	ND
4.	26	5	0.003	ND
5.	31	5	0.004	ND
6.	33	5	0.000	ND
7.	47	5	0.002	ND
8.	48	5	0.002	ND

Reporting limit (mg/L) = 0.1

Recovery (%) = 103.0

Precision (RPD) = 1.92

Sample volume (ml): 1.00

Dilution factor 5

## Sample Set Description:

Test No.: 738-2

Test Day: 0 (2-23-06)

Species: *Neanthes*

overlying water

Analyst:

RSC

Date analysed:

2/23/2006

Dissolved Sulfide in Water: Computation Worksheet				
Methylene Blue Method (SOP #5550)				
<b>Standardization</b>				
1	2	3		
uL PAO titrant employed:	48	76	46	
Working Std. Conc. (mg/L):	3.2			
<b>Result</b>				
Sample description	Dilution factor	OD664	Sulfide (mg/L)	
Blank	---	---	---	
1.0 mL working sulfide std.	---	.167	0.64	
2.0 mL working sulfide std.	---	.342	1.28	
3.0 mL working sulfide std.	---	.530	1.92	
4.0 mL working sulfide std.	---	.655	2.56	
5.0 mL working sulfide std.	---	.838	3.20	
3.0 mL spike	---	.535		
3.0 mL spike dupl.	---	.535		
1.	3	5	.000	
2.	5	5	.000	
3.	11	5	.004	
4.	26	5	.003	
5.	31	5	.004	
6.	33	5	.000	
7.	47	5	.002	
8.	48	5	.002	
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Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: 738-2

Test Day: 0 (2-23-06)

Species: *Neanthes*

overlying water

Analyst: RSC

Date analysed: 2/23/2006



Dissolved Sulfide in Water: Computation Worksheet				
Methylene Blue Method (SOP #5550)				
<b>Standardization</b>		1	2	3
uL PAO titrant employed:		97	102	101
Working Std. Conc. (mg/L):		1.6		
<b>Result</b>				
Sample description	Dilution factor	OD664	Sulfide (mg/L)	
Blank				
1.0 mL working sulfide std.	----	0.165	0.32	
2.0 mL working sulfide std.	----	0.335	0.64	
3.0 mL working sulfide std.	----	0.512	0.96	
4.0 mL working sulfide std.	----	0.675	1.28	
5.0 mL working sulfide std.	----	0.820	1.60	
3.0 mL spike	----	0.500	0.96	
3.0 mL spike dupl.	----	0.505	0.97	
1.	3	5	0.005	ND
2.	5	5	0.000	ND
3.	11	5	0.002	ND
4.	26	5	0.003	ND
5.	31	5	0.000	ND
6.	33	5	0.002	ND
7.	47	5	0.004	ND
8.	48	5	0.003	ND
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Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = 100.4

Precision (RPD) = -1.00

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: 738-2

Test Day: 20 (3-15-06)

Species: *Neanthes*

overlying water

Analyst: RSC

Date analysed: 3/16/2005

Dissolved Sulfide in Water: Computation Worksheet			
Methylene Blue Method (SOP #5550)			
<b>Standardization</b>			
uL PAC titrant employed:	1	2	3
Working Std. Conc. (mg/L):	97	102	101
	3.2		
<b>Result</b>			
Sample description	Dilution factor	OD <sub>664</sub>	Sulfide (mg/L)
Blank	---	---	---
1.0 mL working sulfide std.	---	165	0.64
2.0 mL working sulfide std.	---	335	1.28
3.0 mL working sulfide std.	---	512	1.92
4.0 mL working sulfide std.	---	675	2.56
5.0 mL working sulfide std.	---	820	3.20
3.0 mL spike	---	500	
3.0 mL spike dupl.	---	505	
1. 3	5	005	
2. 5	5	006	
3. 11	5	002	
4. 26	5	007	
5. 31	5	000	
6. 33	5	002	
7. 47	5	004	
8. 48	5	007	
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Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 1.00

Dilution factor: 5

**Sample Set Description:**

Test No.: 738-2

Test Day: 20 (3-15-06)

Species: *Neanthes*

overlying water

Analyst: RSC

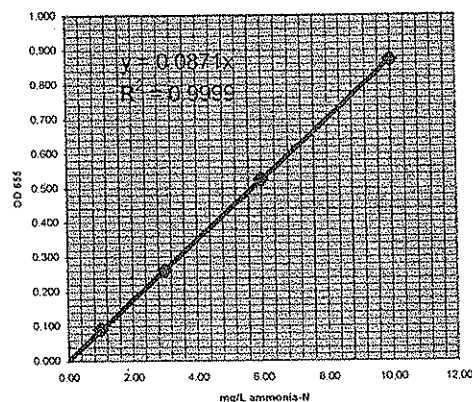
Date analysed: 3/16/2005

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	----	----	----
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.091	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	----	0.260	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	----	0.525	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	----	0.870	10.00
3.0 mg/L spike	----	0.270	3.10
3.0 mg/L spike dupl.	----	0.278	3.19
5.0 mg/L 2nd source	----	0.433	4.97
1. 3	1	0.135	1.55
2. 5	1	0.327	3.75
3. 11	1	0.312	3.58
4. 26	1	0.017	0.20
5. 31	1	0.248	2.85
6. 33	1	0.312	3.58
7. 47	1	0.401	4.60
8. 48	1	0.189	2.17
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Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = 104.8

Precision (RPD) = -2.92

2nd source (%) = 99.4

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-2

Test Day: 0 (2-23-06)

Species: *Neanthes*

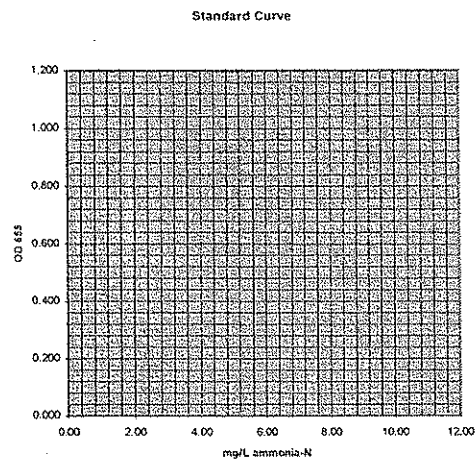
Overlying water

Analyst: RSC  
 Date analysed: 2/23/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	0.91	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	2.60	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	5.25	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	8.70	10.00
3.0 mg/L spike	---	2.70	
3.0 mg/L spike dupl.	---	2.78	
5.0 mg/L 2nd source	---	4.33	
1. 3	1	1.35	
2. 5	1	3.27	
3. 11	1	3.12	
4. 26	1	0.17	
5. 31	1	2.48	
6. 33	1	3.12	
7. 47	1	4.01	
8. 48	1	1.89	
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Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-2

Test Day: 0 (2-23-06)

Species: *Neanthes*

Overlying water

Analyst: RSC

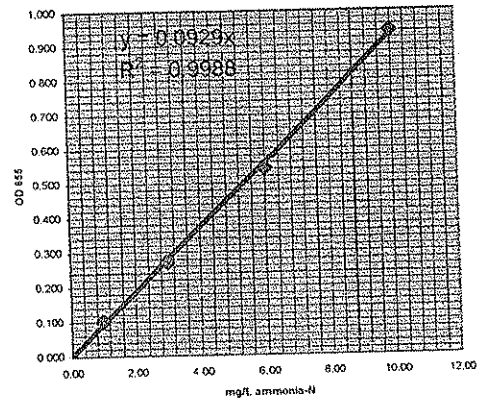
Date analysed: 2/23/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample		Dilution	NH <sub>3</sub> -N	
description		factor	OD <sub>655</sub>	(mg/L)
Blank		-----	-----	-----
1.0 mg/L NH <sub>3</sub> -N Std.		-----	0.102	1.00
3.0 mg/L NH <sub>3</sub> -N Std.		-----	0.272	3.00
6.0 mg/L NH <sub>3</sub> -N Std.		-----	0.542	6.00
10.0 mg/L NH <sub>3</sub> -N Std.		-----	0.940	10.00
3.0 mg/L spike		-----	0.288	3.10
3.0 mg/L spike dupl.		-----	0.293	3.15
5.0 mg/L 2nd source		-----	0.442	4.75
1.	3	1	0.280	3.01
2.	5	1	0.638	6.86
3.	11	1	0.585	6.29
4.	26	1	0.176	1.89
5.	31	1	0.519	5.58
6.	33	1	0.620	6.67
7.	47	1	0.695	7.47
8.	48	1	0.369	3.97
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Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = 104.1

Precision (RPD) = -1.72

2nd source (%) = 95.1

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-2

Test Day: 3 (2-26-06)

Species: *Nearthes*

Overlying water

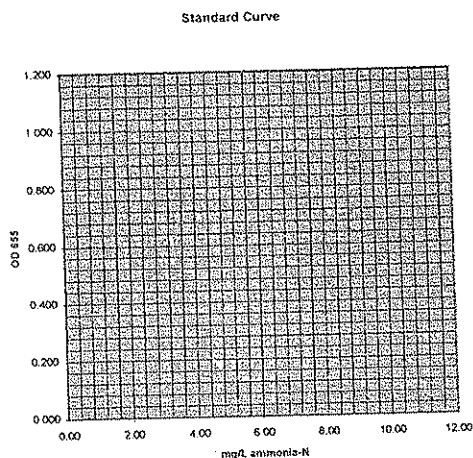
Analyst: RSC

Date analysed: 2/27/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	1.02	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	3.72	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	5.42	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	9.40	10.00
3.0 mg/L spike	---	2.58	---
3.0 mg/L spike dupl.	---	2.93	---
5.0 mg/L 2nd source	---	4.42	---



1.	3	1	2.80
2.	5	1	6.38
3.	11	1	5.85
4.	26	1	1.76
5.	31	1	5.19
6.	33	1	6.20
7.	47	1	6.95
8.	48	1	9.69
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Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-2

Test Day: 3 (2-26-06)

Species: *Neanthes*

Overlying water

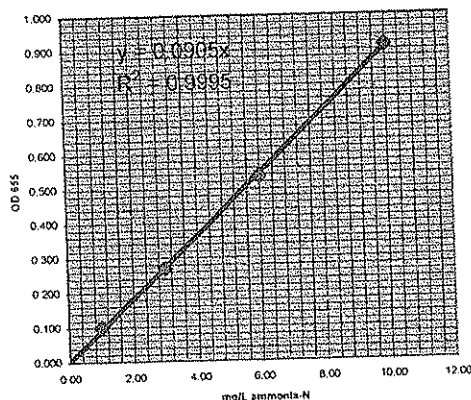
Analyst: RSC  
Date analysed: 2/27/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	-----	-----	-----
1.0 mg/L NH <sub>3</sub> -N Std.	-----	0.100	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	-----	0.270	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	-----	0.535	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	-----	0.910	10.00
3.0 mg/L spike	-----	0.270	2.98
3.0 mg/L spike dupl.	-----	0.275	3.04
5.0 mg/L 2nd source	-----	0.422	4.66
1. 3	1	0.125	1.38
2. 5	1	0.035	0.39
3. 11	1	0.046	0.51
4. 26	1	0.020	0.22
5. 31	1	0.028	0.31
6. 33	1	0.023	0.25
7. 47	1	0.032	0.35
8. 48	1	0.345	3.81

Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = 100.3

Precision (RPD) = -1.83

2nd source (%) = 93.2

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-2

Test Day: 20 (3-15-06)

Species: *Neanthes*

Overlying water

Analyst: RSC

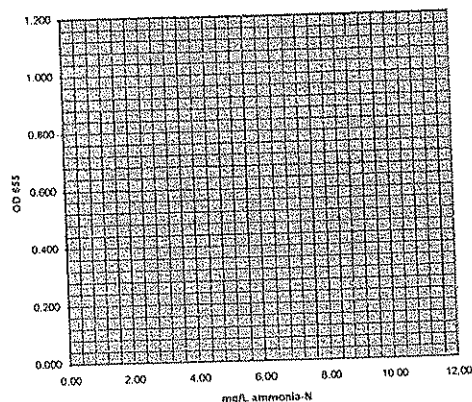
Date analysed: 3/16/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD655	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	100	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	270	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	535	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	910	10.00
3.0 mg/L spike	---	270	---
3.0 mg/L spike dupl.	---	275	---
5.0 mg/L 2nd source	---	422	---
1. 3	1	125	---
2. 5	1	035	---
3. 11	1	046	---
4. 26	1	020	---
5. 31	1	018	---
6. 33	1	023	---
7. 47	1	032	---
8. 48	1	345	---
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Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml) 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-2

Test Day: 20 (3-15-06)

Species: *Neanthes*

Overlying water

Analyst: RSC

Date analysed: 3/16/2006



**TEST DATA ANALYSIS RECORDS**

Neanthes Growth Test  
Randomization Key

2/13/06

BKR	NAS SMPL	CLIENT DESCRIP	REPL	
37	0421G	SD-100	1	
42	0421G	SD-100	2	
36	0421G	SD-100	3	
4	0421G	SD-100	4	
45	0421G	SD-100	5	
48	0421G	SD-100	6	wq replicate
17	0422G	SD-101	1	
13	0422G	SD-101	2	
9	0422G	SD-101	3	
39	0422G	SD-101	4	
2	0422G	SD-101	5	
5	0422G	SD-101	6	wq replicate
40	0423G	SD-102	1	
38	0423G	SD-102	2	
32	0423G	SD-102	3	
34	0423G	SD-102	4	
12	0423G	SD-102	5	
3	0423G	SD-102	6	wq replicate
29	0424G	SD-103	1	
14	0424G	SD-103	2	
16	0424G	SD-103	3	
41	0424G	SD-103	4	
18	0424G	SD-103	5	
47	0424G	SD-103	6	wq replicate
22	0425G	SD-104	1	
30	0425G	SD-104	2	
28	0425G	SD-104	3	
7	0425G	SD-104	4	
21	0425G	SD-104	5	
11	0425G	SD-104	6	wq replicate
46	0426G	REF-EBB	1	
35	0426G	REF-EBB	2	
43	0426G	REF-EBB	3	
24	0426G	REF-EBB	4	
8	0426G	REF-EBB	5	
31	0426G	REF-EBB	6	wq replicate
23	0427G	REF-YB	1	
10	0427G	REF-YB	2	
1	0427G	REF-YB	3	
19	0427G	REF-YB	4	
27	0427G	REF-YB	5	
33	0427G	REF-YB	6	wq replicate
6	0438G	control	1	
20		control	2	
44		control	3	
15		control	4	
25		control	5	
26		control	6	wq replicate

Endpoints Data Entry and Calculations File																							
INDEX	BKR	SMPL	NAS	CLIENT	DESCRIP	REPL	INIT NO.	INIT IW	INIT PPT	SURV	MORT	INIT WT	TARE WT	WT COUNT	TARE WT	WT	PSURV	PMORT	TWT	WT	GR	PSURV	PMORT
BKR=beaker number (=pan number)																							
INIT NO.=initial number of worms exposed																							
INIT IW PPT=interstitial salinity in ppt on day 20																							
SURV=number of worms surviving after 20 days																							
MORT=number of worms dead after 20 days																							
INIT WT=mean weight of worms sampled on day zero (mg)																							
TARE WT=weight of pan used for that replicate on day 20 (mg)																							
WT COUNT=number of worms weighed at test end																							
WT COUNT=TARE WT + weight of worms recovered on day 20 (mg)																							
PSURV=% SURV=100(SURV/INIT NO.)																							
PMORT=%MORT=100(MORT/INIT NO.)																							
TWT=total biomass=FINAL-TARE																							
WT=individual biomass=TWT/WT COUNT																							
GR=individual growth rate=(WT-INIT WT)/20																							
1	37	0421G	SD-100	1	5	0	0.74	85.84	5	172.56	100.0	0.0	86.7	17.3	0.83	Mean	78.1	15.6	0.74	100.0	0.0	0.0	0.0
2	42	0421G	SD-100	2	5	0	0.74	91.77	5	157.43	100.0	0.0	65.7	13.1	0.62	S.D.	8.1	1.6	0.08	0.0	0.0	0.0	0.0
3	38	0421G	SD-100	3	5	0	0.74	91.25	5	171.53	100.0	0.0	80.3	16.1	0.77	n	5	5	5	5	5	5	5
4	4	0421G	SD-100	4	5	0	0.74	91.38	5	173.86	100.0	0.0	82.5	16.5	0.79	n	5	5	5	5	5	5	5
5	45	0421G	SD-100	5	5	0	0.74	91.54	5	166.86	100.0	0.0	75.3	15.1	0.72	n	5	5	5	5	5	5	5
6	48	0421G	SD-100	6	5	0	0.74	91.12	5	159.30	100.0	0.0	88.2	13.6	0.64	Mean	82.5	16.5	0.79	100.0	0.0	0.0	0.0
7	17	0422G	SD-101	1	5	0	0.74	88.92	5	179.76	100.0	0.0	90.8	18.2	0.87	S.D.	11.5	2.3	0.12	0.0	0.0	0.0	0.0
8	13	0422G	SD-101	2	5	0	0.74	90.58	5	163.65	100.0	0.0	73.1	14.6	0.69	n	5	5	5	5	5	5	5
9	9	0422G	SD-101	3	5	0	0.74	84.44	5	179.64	100.0	0.0	95.2	19.0	0.92	n	5	5	5	5	5	5	5
10	39	0422G	SD-101	4	5	0	0.74	90.37	5	175.46	100.0	0.0	85.1	17.0	0.81	n	5	5	5	5	5	5	5
11	2	0422G	SD-101	5	5	0	0.74	85.39	5	179.37	100.0	0.0	94.0	18.8	0.90	Mean	82.7	17.3	0.83	96.0	4.0	8.9	8.9
12	5	0422G	SD-101	6	5	0	0.74	97.01	5	164.91	100.0	0.0	67.9	13.6	0.94	S.D.	11.4	2.2	0.11	8.9	5	5	5
13	40	0423G	SD-102	1	5	0	0.74	82.76	5	168.67	100.0	0.0	85.9	17.2	0.82	n	5	5	5	5	5	5	5
14	38	0423G	SD-102	2	5	0	0.74	84.24	4	157.99	80.0	20.0	73.8	18.4	0.88	n	5	5	5	5	5	5	5
15	32	0423G	SD-102	3	5	0	0.74	83.22	5	185.27	100.0	0.0	92.1	18.4	0.88	n	5	5	5	5	5	5	5
16	34	0423G	SD-102	4	5	0	0.74</																

## Neonates Growth Test

Test no. 738-2

INDEX	BKR	NAS	SMPL	CLIENT	DESCRIP	REPL	INIT	FINAL	INIT	FINAL	INIT	TARE	WT	COUNT	FINAL	PSURV	PMORT	TWT	WT	GR	TWT	WT	GR	PSURV	PMORT
37	23	0427G	REF-YB	1	5	0	0.74	91.86	5	195.87	100.0	0.0	20.8	1.00	112.9	22.6	1.09	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	10	0427G	REF-YB	2	5	0	0.74	87.54	5	222.25	100.0	0.0	134.7	1.31	16.7	3.3	0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	1	0427G	REF-YB	3	5	0	0.74	89.66	5	214.87	100.0	0.0	125.2	1.22	5	5	5	5	5	5	5	5	5	5	5
40	19	0427G	REF-YB	4	5	0	0.74	87.49	5	194.80	100.0	0.0	107.3	1.04	21.5	18.7	0.90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	27	0427G	REF-YB	5	5	0	0.74	91.57	5	184.98	100.0	0.0	93.4	1.39	28.5	17.5	0.84	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	33	0427G	REF-YB	6	5	0	0.74	89.86	5	232.12	100.0	0.0	142.3	0.84	26.2	5.2	0.26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	6	0438G	control	1	5	0	0.74	81.01	5	168.52	100.0	0.0	87.5	0.77	25.0	19.3	0.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	20	0438G	control	2	5	0	0.74	87.50	5	168.33	100.0	0.0	80.8	1.21	5	5	5	5	5	5	5	5	5	5	5
45	44	0438G	control	3	5	0	0.74	96.07	5	221.04	100.0	0.0	125.0	0.93	96.7	19.3	0.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	15	0438G	control	4	5	0	0.74	89.96	5	186.67	100.0	0.0	96.7	0.93	19.3	19.3	0.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	25	0438G	control	5	5	0	0.74	89.96	5	186.67	100.0	0.0	96.7	0.93	19.3	19.3	0.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	26	0438G	control	6	5	0	0.74	89.96	5	186.67	100.0	0.0	96.7	0.93	19.3	19.3	0.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Project Name: P738-2 Neanthes growth rate

Sample: x1  
 Samp ID: SD-100  
 Alias: NAS #0421G  
 Replicates: 5  
 Mean: 0.746  
 SD: 0.081  
 Tr Mean: 0.746  
 Trans SD: 0.081

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 0.788  
 SD: 0.118  
 Tr Mean: 0.788  
 Trans SD: 0.118

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 0.066 SS: 0.082 K: 5 b: 0.28  Alpha Level: 0.05 Calculated Value: 0.9582 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 0.061 Test Residual SD: 0.044 Ref. Residual Mean: 0.09 Ref. Residual SD: 0.063 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 0.8424 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: No Transformation  Experimental Hypothesis Null: $x_1 \geq x_2$ Alternate: $x_1 < x_2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.05 Calculated Value: 0.6559 Critical Value: $\geq 1.86$ <u>Accept Null Hypothesis: Yes</u>  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0.83	0.83	0.82	0.82	0.084	0.032			-0.126
2	0.62	0.62	0.69	0.69	0.126	0.098			-0.098
3	0.77	0.77	0.98	0.98	0.024	0.192			-0.078
4	0.79	0.79	0.74	0.74	0.044	0.048			-0.048
5	0.72	0.72	0.71	0.71	0.026	0.078			-0.026
6									0.024
7									0.032
8									0.044
9									0.084
10									0.192

Data entry verified against EXCEL spreadsheet.

Average individual growth rate in test sediment SD-100 is not significantly less than that in reference sediment REF-EBB at  $\alpha=0.05$

Project Name: P738-2 Neanthes growth rate

Sample: x1  
 Samp ID: SD-101  
 Alias: NAS #0422G  
 Replicates: 5  
 Mean: 0.786  
 SD: 0.118  
 Tr Mean: 0.786  
 Trans SD: 0.118

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 0.788  
 SD: 0.118  
 Tr Mean: 0.788  
 Trans SD: 0.118

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 0.077 SS: 0.112 K: 5 b: 0.325  Alpha Level: 0.05 Calculated Value: 0.9443 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 0.097 Test Residual SD: 0.048 Ref. Residual Mean: 0.09 Ref. Residual SD: 0.063 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 0.2036 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: No Transformation  Experimental Hypothesis Null: $x1 \geq x2$ Alternate: $x1 < x2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.05 Calculated Value: 0.0267 Critical Value: $\geq 1.86$ Accept Null Hypothesis: Yes  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0.64	0.64	0.82	0.82	0.146	0.032			-0.146
2	0.87	0.87	0.69	0.69	0.084	0.098			-0.098
3	0.69	0.69	0.98	0.98	0.096	0.192			-0.096
4	0.92	0.92	0.74	0.74	0.134	0.048			-0.078
5	0.81	0.81	0.71	0.71	0.024	0.078			-0.048
6									0.024
7									0.032
8									0.084
9									0.134
10									0.192

Data entry verified against EXCEL spreadsheet.  
 Average individual growth rate in test sediment SD-101 is not significantly less than that in reference sediment REF-EBB at  $\alpha=0.05$

*MLR 6-5-06*

Project Name: P738-2 Neanthes growth rate

Sample: x1  
 Samp ID: SD-102  
 Alias: NAS #0423G  
 Replicates: 5  
 Mean: 0.824  
 SD: 0.107  
 Tr Mean: 0.824  
 Trans SD: 0.107

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 0.788  
 SD: 0.118  
 Tr Mean: 0.788  
 Trans SD: 0.118

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 0.073 SS: 0.102 K: 5 b: 0.316  Alpha Level: 0.05 Calculated Value: 0.9803 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 0.075 Test Residual SD: 0.066 Ref. Residual Mean: 0.09 Ref. Residual SD: 0.063 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 0.3525 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: No Transformation  Experimental Hypothesis Null: $x1 \geq x2$ Alternate: $x1 < x2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.05 Calculated Value: -0.5046 Critical Value: $\geq 1.86$ Accept Null Hypothesis: Yes  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0.9	0.9	0.82	0.82	0.076	0.032			-0.184
2	0.64	0.64	0.69	0.69	0.184	0.098			-0.098
3	0.82	0.82	0.98	0.98	0.004	0.192			-0.078
4	0.88	0.88	0.74	0.74	0.056	0.048			-0.048
5	0.88	0.88	0.71	0.71	0.056	0.078			-0.004
6									0.032
7									0.056
8									0.056
9									0.076
10									0.192

Data entry verified against EXCEL spreadsheet.  
 Average individual growth rate in test sediment SD-102 is not significantly less than that in reference sediment REF-EBB at  $\alpha=0.05$

Project Name: P738-2 Neanthes growth rate

Sample: x1  
 Samp ID: SD-103  
 Alias: NAS #0424G  
 Replicates: 5  
 Mean: 0.728  
 SD: 0.168  
 Tr Mean: 0.728  
 Trans SD: 0.168

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 0.788  
 SD: 0.118  
 Tr Mean: 0.788  
 Trans SD: 0.118

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 0.094 SS: 0.168 K: 5 b: 0.372  Alpha Level: 0.05 Calculated Value: 0.8232 Critical Value: $\leq 0.842$  Normally Distributed: No  Override Option: Not Invoked	Test Residual Mean: 0.146 Test Residual SD: 0.04 Ref. Residual Mean: 0.09 Ref. Residual SD: 0.063 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 1.6876 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Mann-Whitney Balanced Design: Yes Transformation: rank-order  Experimental Hypothesis Null: $x1 \geq x2$ Alternate: $x1 < x2$  Mann-Whitney N1: 5 Mann-Whitney N2: 5 Degrees of Freedom: Experimental Alpha Level: <u>0.05</u> Calculated Value: 17 Critical Value: $\geq 21.0$ <u>Accept Null Hypothesis: Yes.</u>  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0.88	8	0.82	7	0.152	0.032	0.6		-0.128
2	0.6	1	0.69	4	0.128	0.098	0.61		-0.118
3	0.94	9	0.98	10	0.212	0.192	0.61		-0.118
4	0.61	2.5	0.74	6	0.118	0.048	0.69		-0.098
5	0.61	2.5	0.71	5	0.118	0.078	0.71		-0.078
6							0.74		-0.048
7							0.82		0.032
8							0.88		0.152
9							0.94		0.192
10							0.98		0.212

Data entry verified against EXCEL spreadsheet.

Average individual growth rate in test sediment SD-103 is not significantly less than that in reference sediment REF-EBB at  $\alpha=0.05$



Project Name: P738-2 Neanthes growth rate

Sample: x1  
 Samp ID: SD-104  
 Alias: NAS #0425G  
 Replicates: 5  
 Mean: 0.802  
 SD: 0.11  
 Tr Mean: 0.802  
 Trans SD: 0.11

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 0.788  
 SD: 0.118  
 Tr Mean: 0.788  
 Trans SD: 0.118

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 0.074 SS: 0.105 K: 5 b: 0.322  Alpha Level: 0.05 Calculated Value: 0.9909 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 0.082 Test Residual SD: 0.062 Ref. Residual Mean: 0.09 Ref. Residual SD: 0.063 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 0.2028 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: No Transformation  Experimental Hypothesis Null: $x1 \geq x2$ Alternate: $x1 < x2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.05 Calculated Value: -0.1936 Critical Value: $\geq 1.86$ Accept Null Hypothesis: Yes  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0.77	0.77	0.82	0.82	0.032	0.032			-0.172
2	0.63	0.63	0.69	0.69	0.172	0.098			-0.098
3	0.91	0.91	0.98	0.98	0.108	0.192			-0.078
4	0.82	0.82	0.74	0.74	0.018	0.048			-0.048
5	0.88	0.88	0.71	0.71	0.078	0.078			-0.032
6									0.018
7									0.032
8									0.078
9									0.108
10									0.192

Data entry verified against EXCEL spreadsheet.

Average individual growth rate in test sediment SD-104 is not significantly less than that in reference sediment REF-EBB at  $\alpha=0.05$

Water Quality Data													
BKR	NAS	CLIENT	REPL	DAY	Overlying water								
	SMPL	DESCRIP			TEMP	pH	SAL	DO	S	< or >	NH4+NH3	< or >	NH3
3	0423G	SD-102	6	0	20.7	7.7	25.0	6.6	<0.1		1.6		0.003
5	0422G	SD-101	6	0	20.8	7.7	26.0	7.0	<0.1		3.8		0.016
11	0425G	SD-104	6	0	21.0	7.7	25.5	7.0	<0.1		3.6		0.015
26	0438G	control	6	0	20.9	7.9	26.0	6.9	<0.1		0.2		0.001
31	0426G	REF-EBB	6	0	21.0	7.7	26.0	6.8	<0.1		2.9		0.008
33	0427G	REF-YB	6	0	20.8	7.9	26.0	6.9	<0.1		3.6		0.012
47	0424G	SD-103	6	0	21.0	7.7	25.0	6.9	<0.1		4.6		0.016
48	0421G	SD-100	6	0	20.7	7.7	25.5	6.9	<0.1		2.2		0.007
3	0423G	SD-102	6	3	20.7	7.4	27.0	7.0			3.0		0.013
5	0422G	SD-101	6	3	20.5	7.8	27.0	6.8			6.9		0.018
11	0425G	SD-104	6	3	20.3	7.8	26.5	6.6			6.3		0.010
26	0438G	control	6	3	20.1	7.9	26.0	6.4			1.9		0.002
31	0426G	REF-EBB	6	3	20.6	7.7	27.0	7.1			5.6		0.029
33	0427G	REF-YB	6	3	20.1	7.9	27.0	6.6			6.7		0.011
47	0424G	SD-103	6	3	20.0	7.7	26.5	6.9			7.5		0.024
48	0421G	SD-100	6	3	20.2	7.7	27.0	6.8			4.0		0.010
3	0423G	SD-102	6	6	20.5	7.3	27.5	6.2					
5	0422G	SD-101	6	6	20.2	7.8	28.5	7.0					
11	0425G	SD-104	6	6	20.1	7.8	28.0	6.4					
26	0438G	control	6	6	19.7	7.8	29.0	7.0					
31	0426G	REF-EBB	6	6	20.1	7.8	27.5	6.6					
33	0427G	REF-YB	6	6	19.8	7.8	28.0	7.0					
47	0424G	SD-103	6	6	20.1	7.8	27.0	6.7					
48	0421G	SD-100	6	6	20.1	7.7	27.0	6.8					
3	0423G	SD-102	6	9	20.0	7.5	27.5	5.9					
5	0422G	SD-101	6	9	19.9	7.8	29.0	7.1					
11	0425G	SD-104	6	9	19.7	7.8	28.0	6.6					
26	0438G	control	6	9	19.5	7.8	28.5	7.1					
31	0426G	REF-EBB	6	9	19.9	7.7	28.0	6.3					
33	0427G	REF-YB	6	9	19.3	7.8	28.5	7.1					
47	0424G	SD-103	6	9	19.8	7.9	28.0	6.6					
48	0421G	SD-100	6	9	19.7	7.7	27.5	6.8					
3	0423G	SD-102	6	12	20.2	7.5	29.0	5.4					
5	0422G	SD-101	6	12	19.9	7.8	30.0	6.6					
11	0425G	SD-104	6	12	19.7	7.8	30.0	6.2					
26	0438G	control	6	12	19.6	7.8	30.0	6.7					
31	0426G	REF-EBB	6	12	19.9	7.7	30.0	5.9					
33	0427G	REF-YB	6	12	19.7	7.8	30.0	6.3					
47	0424G	SD-103	6	12	19.8	7.8	29.5	6.4					
48	0421G	SD-100	6	12	19.8	7.8	29.0	6.2					
3	0423G	SD-102	6	15	20.1	7.4	28.5	6.0					
5	0422G	SD-101	6	15	19.5	7.8	29.0	7.2					
11	0425G	SD-104	6	15	19.6	7.8	28.0	6.9					
26	0438G	control	6	15	19.4	7.8	29.0	6.7					
31	0426G	REF-EBB	6	15	19.6	7.7	27.0	7.0					
33	0427G	REF-YB	6	15	19.3	7.8	28.0	7.1					
47	0424G	SD-103	6	15	19.6	7.8	28.5	6.8					
48	0421G	SD-100	6	15	19.6	7.8	27.0	7.0					
3	0423G	SD-102	6	18	19.6	7.7	30.0	7.0					

*Data entry  
verified against  
laboratory bench  
sheets*  
*MUR*  
*3-27-06*

Page 40 of 41

**CHAIN-OF-CUSTODY RECORDS**

## Sample Chain-of-Custody/Analysis Request

## Possible Hazards

Client: Enviro Logic Resources Report to: Taku Fuji  
 Site: Astoria Area-Wide Company: Kennedy/Jenks  
 Project No.: 0592004.00 Address: 200 SW Market St. #500  
 Sampler Name: Tom Pinit / Cindy Byals Portland, OR 97201  
 Telephone: 503-245-4911 Fax: 503-245-4901

Lab Destination: Northwestern Aquatic SciencesAddress: 3814 Yaquina Bay Rd.Newport, OR 97365Telephone: 541-265-7225

Carrier/Way Bill No.

Lab ID No.	Client ID No.	Collection		Depth	Comp.	Pres.	Turn around	Analysis Requested	Comment/Conditions (container type, container number, etc.)
		Date	Time						
SD-100		1/24/06	1145	S	0421G	NAS		Measure interstitial ammonia & sulfide upon receipt	5 x 1-L glass
SD-101			1220	S	0422G				
SD-102			1300	S	0423G				
SD-103			1330	S	0424G				
SD-104			1400	S	0425G			Hold until further directed (awaiting chemical analyses)	
REF-EBB			1630	S	0426G				Reference
REF-YB			1510	S	0427G				Reference
									gears were full (no head space)
									water temperatures: 1.5°C, 3.0°C, 2.0°C

(1) Write only one sample number in each space.

(2) Specify type of sample(s): Water (W), Solid (S), or indicate type.

(3) Mark each sample which should be composited in Laboratory as follows: Place an "A" in box for each sample that should be composited into one sample; use sequential letter for additional groups.

(4) Preservation of sample.

(5) Write each analysis requested across top. Place an "X" in appropriate column to indicate type of analysis needed for each sample.

Sample Requested By				Sample Received By			
Print Name	Signature	Date	Time	Print Name	Signature	Date	Time
P. THOMAS PINIT	P. Jedd	1/27/06	1200	Michele S. Redmond	Michele S. Redmond	1/27/06	13:45

**REFERENCE TOXICANT RESULTS AND ANALYSIS**

## ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2091 Client: \_\_\_\_\_ QC TestInvestigator PP-1-6 <sup>revised</sup> MR

Test Type (range-finding/definitive) \_\_\_\_\_ definitive

Test Length (hr) 96 <sup>6-5-06</sup>Species Neanthes arenaceodentata

## STUDY MANAGEMENT

Client: \_\_\_\_\_ QC test

Client's Study Monitor: \_\_\_\_\_ N/A

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir. M.S. Redmond MRQA Officer L.K. Nemeth

- |                                 |                                     |
|---------------------------------|-------------------------------------|
| 1. <u>Susan Gaff</u> <u>SG</u>  | 2. <u>Bill Montgomery</u> <u>WM</u> |
| 3. <u>Greg Hultin</u> <u>GH</u> | 4. _____                            |
| 5. _____                        | 6. _____                            |

Study Schedule:

Test Beginning: 2-28-06 11:30Test Ending: 3-4-06 1030 hrs

## TEST MATERIAL

Description: Cadmium as CdCl<sub>2</sub>·2.5H<sub>2</sub>O, Aldrich Lot #12422KB, 1.0 mg/mL stock prepared: 7-13-04

## DILUTION WATER

Description: Yaquina Bay, Oregon, sea waterDate of Preparation/Collection: 2-21-06Water Quality: Cond. (umhos/cm): \_\_\_\_\_ Salinity (ppt) 28.0 pH 8.0Hardness (mg/L as CaCO<sub>3</sub>): \_\_\_\_\_ Alkalinity (mg/L as CaCO<sub>3</sub>): \_\_\_\_\_Treatments: Filtered to < 0.40 um, salinity-adjusted with Milli-Q deionized water, aerated

## TEST LOCATION

Test conducted in (circle one): room 1 room 2 trailer water bath

Other: Room #3

Randomization chart:

D	Ø	6.25	3.13	1.56	25	12.5				
C	3.13	12.5	Ø	6.25	1.56	25				
B	1.56	Ø	3.13	6.25	25	12.5				
A	Ø	1.56	3.13	12.5	25	6.25				

Error codes: 1) Correction of handwriting error

2) Written in wrong location; entry deleted

3) Wrong date deleted; replaced with correct date

4) Error found in measurement; measurement repeated

## ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2091 Client \_\_\_\_\_ QC Test \_\_\_\_\_ Investigator \_\_\_\_\_

## TEST ORGANISMS

Species: Neanthes arenaceodentataAge: \_\_\_\_\_ Size: 0.74 mgSource: Dept. of Biology, CA State University, Long Beach, CADate received: 2-21-06

## Acclimation Data:

Date	Temp. (deg.C)	pH	Salinity (ppt)	DO (mg/L)	Feeding		Water changes	Comments
					amount	description		
2-21-06	13.8	7.0	34.0	7.6	0.19/trunk	Tetramarine	yes	receiving water
2-22-06	20.4	7.9	29.5	6.8			yes	
2-23-06	20.7	7.8	29.0	7.8	0.19/trunk	Tetramarine		
2-28-06	20.7	7.8	29.0	7.4	"	"		
Mean	18.9	7.6	30.3	7.4				
S.D.	3.4	0.4	2.4	0.4				
(N)	4	4	4	4				

Photoperiod during acclimation: not recorded

## TEST PROCEDURES AND CONDITIONS

Test concentrations (50% series recommended): \_\_\_\_\_

25, 12.5, 6.25, 3.13, 1.56 and 0 mg/L

Test chamber: 250 mL beakerTest volume: 100 mLReplicates/treatment: 4Organisms/treatment: 20 (5/replicate)Test water changes: noneAeration during test: noneFeeding: noneDuration: 24-hr, 48-hr, 96-hrTest temperature (deg.C): 20.0 +/- 1.0Beaker placement: Stratified randomizationPhotoperiod: constant lightTest salinity (ppt): 28.0 +/- 2.0

## MISCELLANEOUS NOTES

Test solution preparation:

Concentration (mg/L)	mL of 1.0 mg/mL stock per 400 mL	Each concentration made up to 400 mL with dilution water and divided between four replicates
25	10	
12.5	5	
6.25	2.5	
3.13	1.25	
1.56	0.62	
0	0	

Light intensity measurements: \_\_\_\_\_

Date \_\_\_\_\_

Location \_\_\_\_\_

foot-candles \_\_\_\_\_



## ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2091Client QC Test

Investigator \_\_\_\_\_

## DAILY RECORD SHEET

Day 0 (2/28/06) 64

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors			
					A	B	C	D
1. 25	19.1	8.0	27.0	7.6	5	5	5	5
2. 12.5	19.1	8.0	27.0	7.6	5	5	5	5
3. 6.25	19.1	8.0	27.0	7.6	5	5	5	5
4. 3.13	19.1	8.0	27.0	7.6	5	5	5	5
5. 1.56	19.1	8.0	27.0	7.6	5	5	5	5
6. 0	19.2	8.0	27.0	7.6	5	5	5	5

Day 1 (3/1/06) W

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors			
					A	B	C	D
1. 25	20.4	7.9	27.5	7.1	0(5d)	0(5d)	0(5d)	0(5d)
2. 12.5	20.4	7.9	28.0	7.0	5	5	5	5
3. 6.25	20.5	7.9	27.5	6.9	5	5	5	5
4. 3.13	20.3	7.9	28.0	7.0	5	5	5	5
5. 1.56	20.5	7.9	27.5	7.0	5	5	5	5
6. 0	20.5	7.8	27.5	6.8	5	5	5	5

Day 2 (3/2/06) W

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors			
					A	B	C	D
1. 25	-	-	-	-	0	0	0	0
2. 12.5	20.3	7.8	28.5	6.9	3(2d)	2(2d)	2(3d)	3(2d)
3. 6.25	20.6	7.8	28.5	6.9	5	5	5	5
4. 3.13	20.3	7.8	28.5	6.8	5	5	5	5
5. 1.56	20.4	7.8	28.0	6.8	5	5	5	5
6. 0	20.5	7.7	28.0	6.6	5	5	5	5

Day 3 (3/3/06) W

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors			
					A	B	C	D
1. 25	-	-	-	-	0	0	0	0
2. 12.5	20.4	7.8	29.0	7.2	0(2d)	1(1d)	0(6d)	0(3d)
3. 6.25	20.6	7.8	29.0	7.1	5	5	5	5
4. 3.13	20.4	7.8	29.0	7.0	5	5	5	5
5. 1.56	20.5	7.8	29.0	7.0	5	5	5	5
6. 0	20.7	7.8	28.5	6.7	5	5	5	5

Day 4 (3/4/06) W

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors			
					A	B	C	D
1. 25	-	-	-	-	0	0	0	0
2. 12.5	20.5	7.9	29.5	7.1	0	0(1d)	0	0
3. 6.25	20.6	7.9	28.5	7.0	5	5	5	5
4. 3.13	20.3	7.9	29.5	7.1	5	5	5	5
5. 1.56	20.5	7.8	29.0	7.1	5	5	5	5
6. 0	20.6	7.8	28.5	6.8	4(1m)	5	5	5

\*WQ in B replicate

WQ: Mean 20.2 7.9 28.1 7.1  
 SD 0.6 0.1 0.8 0.3  
 n 27 27 27 27

## CETIS Test Summary

Report Date:

30 Mar-06 11:24 AM

Test Link:

07-9836-7417/999-2091

## Reference Toxicant 96-h Acute Survival Test

Northwestern Aquatic Sciences

Test No:	02-1617-6083	Test Type:	Survival	Duration:	95h
Start Date:	28 Feb-06 11:30 AM	Protocol:		Species:	Neanthes arenaceodentata
Ending Date:	04 Mar-06 10:30 AM	Dil Water:	Yaquina Bay Seawater	Source:	California State U, Long Beach
Setup Date:	28 Feb-06 11:30 AM	Brine:			

Sample No:	08-1613-9556	Material:	Cadmium chloride	Client:	QC Test
Sample Date:	28 Feb-06 11:30 AM	Code:	816139556	Project:	
Receive Date:		Source:	Reference Toxicant		
Sample Age:	N/A	Station:			

## Comparison Summary

Analysis	Endpoint	NOEL	LOEL	ChV	PMSD	Method
05-9653-6459	Proportion Survived	6.25	12.5	8.8388	9.32%	Steel Many-One Rank

## Point Estimate Summary

Analysis	Endpoint	% Effect	Conc-mg/L	95% LCL	95% UCL	Method
12-6002-0103	Proportion Survived	LC50	8.838835	7.569769	10.32066	Trimmed Spearman-Kärber

## Proportion Survived Summary

Conc-mg/L	Control Type	Reps	Mean	Minimum	Maximum	SE	SD	CV
0	Dilution Water	4	0.95000	0.80000	1.00000	0.05000	0.10000	10.53%
1.56		4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
3.13		4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
6.25		4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12.5		4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%
25		4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00%

Report Date: 30 Mar-06 11:19 AM

Link: 07-9836-7417/999-2091

## CETIS Data Worksheet

Reference Toxicant 96-h Acute Survival Test

Northwestern Aquatic Sciences

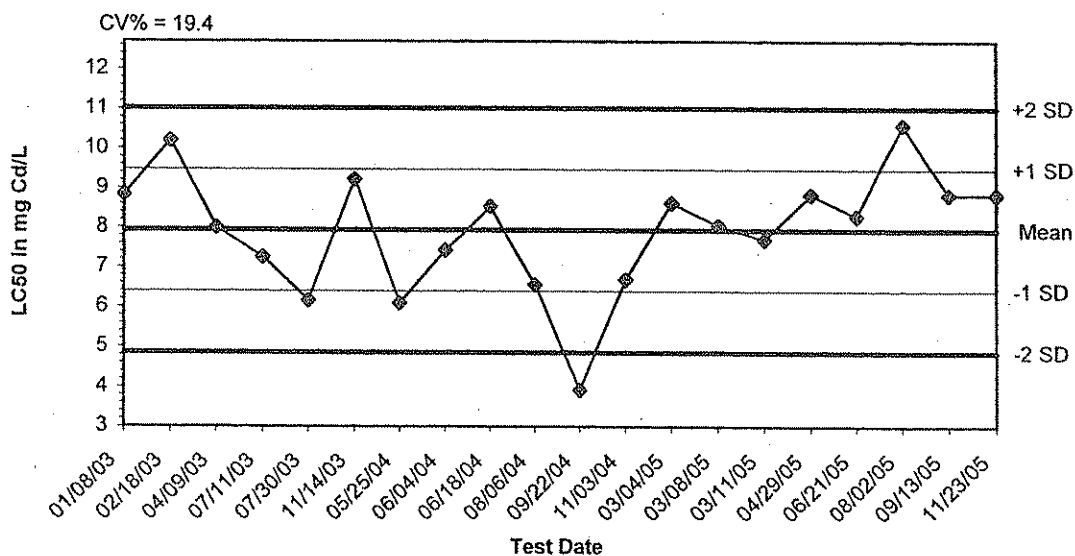
Start Date: 28 Feb-06 11:30 AM Species: Neanthes arenaceodentata  
 Ending Date: 04 Mar-06 10:30 AM Protocol:  
 Sample Date: 28 Feb-06 11:30 AM Material: Cadmium chloride

Sample Code: 816139556  
 Sample Source: Reference Toxicant  
 Sample Station:

Conc-mg/L	Code	Rep	Pos	# Exposed	# Survived	Notes
0	D	1	3	5	4	
0	D	2	22	5	5	
0	D	3	5	5	5	
0	D	4	4	5	5	
1.56		1	15	5	5	
1.56		2	8	5	5	
1.56		3	19	5	5	
1.56		4	18	5	5	
3.13		1	9	5	5	
3.13		2	17	5	5	
3.13		3	1	5	5	
3.13		4	6	5	5	
6.25		1	7	5	5	
6.25		2	14	5	5	
6.25		3	12	5	5	
6.25		4	2	5	5	
12.5		1	24	5	0	
12.5		2	13	5	0	
12.5		3	21	5	0	
12.5		4	10	5	0	
25		1	23	5	0	
25		2	20	5	0	
25		3	16	5	0	
25		4	11	5	0	

*Data entry verified against laboratory bench sheets*  
*mid*  
*3-30-06*

**Neanthes arenaceodentata 96-hr reference toxicant test - last 20 points**



Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
01/08/03	8.8400	7.9360	6.3964	4.8567	9.4756	11.0153
02/18/03	10.2000	7.9360	6.3964	4.8567	9.4756	11.0153
04/09/03	8.0000	7.9360	6.3964	4.8567	9.4756	11.0153
07/11/03	7.2500	7.9360	6.3964	4.8567	9.4756	11.0153
07/30/03	6.1600	7.9360	6.3964	4.8567	9.4756	11.0153
11/14/03	9.2300	7.9360	6.3964	4.8567	9.4756	11.0153
05/25/04	6.1000	7.9360	6.3964	4.8567	9.4756	11.0153
06/04/04	7.4300	7.9360	6.3964	4.8567	9.4756	11.0153
06/18/04	8.5400	7.9360	6.3964	4.8567	9.4756	11.0153
08/06/04	6.5600	7.9360	6.3964	4.8567	9.4756	11.0153
09/22/04	3.9200	7.9360	6.3964	4.8567	9.4756	11.0153
11/03/04	6.6900	7.9360	6.3964	4.8567	9.4756	11.0153
03/04/05	8.6300	7.9360	6.3964	4.8567	9.4756	11.0153
03/08/05	8.0600	7.9360	6.3964	4.8567	9.4756	11.0153
03/11/05	7.7000	7.9360	6.3964	4.8567	9.4756	11.0153
04/29/05	8.8400	7.9360	6.3964	4.8567	9.4756	11.0153
06/21/05	8.2900	7.9360	6.3964	4.8567	9.4756	11.0153
08/02/05	10.6000	7.9360	6.3964	4.8567	9.4756	11.0153
09/13/05	8.8400	7.9360	6.3964	4.8567	9.4756	11.0153
11/23/05	8.8400	7.9360	6.3964	4.8567	9.4756	11.0153

*msk*  
*12/2/05*

**Report**  
**of**  
**Test No. 738-3**  
**Larval Sediment Toxicity Test with**  
***Mytilus galloprovincialis***

**Submitted to**  
**Kennedy/Jenks Consultants**  
**200 S.W. Market St., Suite 500**  
**Portland, OR 97201**

**Submitted by**  
**Northwestern Aquatic Sciences**  
**3814 Yaquina Bay Road**  
**P.O. Box 1437**  
**Newport, OR 97365**

**June 13, 2006**

## TOXICITY TEST REPORT

## TEST IDENTIFICATION

Test No.: 738-3

Title: *Mytilus galloprovincialis* larval sediment toxicity test of marine sediments.

Protocol: NAS-XXX-CG4/MG4, June 20, 1990. Rev. 2 (Feb.10, 1997). Based on: Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments (PSEP 1995), with modifications as specified by the Dredged Material Management Program (DMMP, formerly Puget Sound Dredged Disposal Analysis Program or PSDDA).

## STUDY MANAGEMENT

Study Sponsor: Kennedy/Jenks Consultants, 200 S.W. Market St., Suite 500, Portland, OR 97201

Sponsor's Study Monitor: Dr. Taku Fuji

Testing Laboratory: Northwestern Aquatic Sciences, P.O. Box 1437, Newport, Oregon 97365.

Test Location: Newport Laboratory.

Laboratory's Study Personnel: M.S. Redmond, M.S., Proj. Mngr.; G.J. Irissarri, B.S., Study Dir.; L.K. Nemeth, B.A., M.B.A., QA Officer; R.S. Caldwell, Ph.D., Sr. Aq. Toxicol.; G.A. Buhler, B.S., Aq. Toxicol.; W.T. Montgomery, A.A., Sr. Tech.; S. J. Gage, B.A., Tech.

Study Schedule:

Test Beginning: 2-21-06, 1420 hrs.

Test Ending: 2-23-06, 1600 hrs.

Disposition of Study Records: All specimens, raw data, reports and other study records are stored according to Good Laboratory Practice regulations at Northwestern Aquatic Sciences, 3814 Yaquina Bay Rd., Newport, OR 97365.

Good Laboratory Practices: The test was conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

Statement of Quality Assurance: The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with the protocol and standard operating procedures. This report is an accurate reflection of the raw data.

## TEST MATERIAL

Test Sediments: Five test sediments and two reference sediments were tested. Details follow:

NAS Sample No.	0421G	0422G	0423G	0424G
Sample Description	SD-100	SD-101	SD-102	SD-103
Collection Date	1-26-06	1-26-06	1-26-06	1-26-06
Receipt Date	1-27-06	1-27-06	1-27-06	1-27-06
Interstitial Salinity (‰)	1.5	3.0	1.0	4.5
NAS Sample No.	0425G	0426G	0427G	
Sample Description	SD-104	REF-EBB	REF-YB	
Collection Date	1-26-06	1-26-06	1-26-06	
Receipt Date	1-27-06	1-27-06	1-27-06	
Interstitial Salinity (‰)	5.0	5.0	7.0	

Storage: Upon receipt, sample containers were completely full(no headspace). Samples were stored at 4°C in the dark.

Treatments: The samples were homogenized by mixing with stainless steel implements.

## TEST WATER

Source: Yaquina Bay, Oregon

Date of Collection: 2-20-06

Water Quality: Salinity 28.0 ‰, pH 7.9

Pretreatment: Filtered to  $\leq 0.40 \mu\text{m}$ , salinity-adjusted with MilliQ® deionized water, aerated.

**TEST ORGANISMS**

Species: *Mytilus galloprovincialis*

Age: 2 hrs post-fertilization

Source: Mussels were purchased from Carlsbad Aquafarm, Carlsbad, CA, and received on 2-15-06.

Acclimation: Adult animals were held under outside ambient conditions. Average conditions during the week prior to testing were: temperature,  $5.7 \pm 2.1^{\circ}\text{C}$ ; pH,  $8.0 \pm 0.2$ ; salinity,  $31.3 \pm 2.0$ ‰; dissolved oxygen,  $11.2 \pm 1.2$  mg/L.

Source of Gametes: 9 females, 4 males

**TEST PROCEDURES AND CONDITIONS**

The following is an abbreviated statement of the test procedures and a statement of the test conditions actually employed. See the test protocol (Appendix I) for a more detailed description of the test procedures used in this study.

Test Chambers: 1 L covered borosilicate glass beakers

Test Volumes: 18 g of test or reference sediment with 900 ml of test water added. Sediment was mixed for 10 seconds and allowed to settle for the normal period of 4 hours as specified in the protocol.

Replicates/Treatment: 5 (plus a 6th water quality replicate).

Sediment Salinity Adjustment: None required.

Initial Concentration of Test Organisms: 23.1/ml

Water volume changes per 24 hours: None

Volume of Subsamples Taken for Counting: 10 ml

Aeration: Yes

Feeding: None

Acceptance Criteria: The percent normal larvae in the seawater control must be  $\geq 70\%$  at the end of the test.

Performance Criteria: For DMMP projects, the mean seawater-normalized combined mortality and abnormality in the reference sediments must be  $\leq 35\%$ .

Effects Criteria: The effects criteria used were: 1) mortality; 2) abnormal development to the fully-shelled stage; and 3) the combined mortality/abnormality endpoint. Normal development is defined as transformation to the fully shelled, straight-hinged, D-shaped prodissoconch I stage. Data collected were: 1) the initial embryo density; 2) the number of abnormal larvae observed, and 3) the number of normal larvae observed. The results were expressed as: 1) percent abnormality; 2) percent mortality; 3) combined percent mortality and abnormality; and 4) normalized (to the seawater control) a) percent mortality and b) combined percent mortality and abnormality.

Water Quality and Other Test Conditions: The temperature, pH, salinity, and dissolved oxygen were measured in the water quality replicate test chamber daily. Total soluble sulfide and total ammonia-N were measured in the overlying water of the water quality replicate test chamber on days 0 and 2. Total soluble sulfide and total ammonia-N were measured using Hach reagents based on the methylene blue (EPA Method 376.2) and salicylate (Clin. Chim. Acta 14:403, 1996) colorimetric methods, respectively; samples were not distilled prior to analysis. The photoperiod was 14:10, L:D.

**DATA ANALYSIS METHODS**

All three standard endpoints, percent abnormal, percent combined mortality/abnormality, and percent mortality have occasionally been computed both with, and without, normalization for the seawater control. Endpoints in this report have been computed according to the following formulas:

$$\text{PABN (Percent Abnormality)} = 100 \cdot (A/T)$$

$$\text{PABND (Combined Percent Mortality/Abnormality)} = 100 \cdot ((I-N)/I)$$

$$\text{PMORT (Percent Mortality)} = 100 \cdot ((I-T)/I)$$

$$\text{NPM (Normalized Percent Mortality)} = 100 \cdot (1 - (T/TS))$$

$$\text{NCMA (Normalized Combined Percent Mortality/Abnormality)} = 100 \cdot (1 - (N/NS))$$

where the following are counts per 10 ml subsample:

N = normal larvae counted  
 A = abnormal larvae counted  
 T = N+A (total larvae counted)  
 I = number of inoculated embryos (from average of zero time counts)  
 TS = average of total larvae counted in seawater controls  
 NS = average of normal larvae counted in seawater controls

Control and treatment means and standard deviations for the biological endpoints described above and for water quality data were computed using Microsoft EXCEL 2000. The software used for statistical comparisons was BioStat (Beta v.4.1 (EXCEL)) bioassay software developed by the U.S. Army Corps of Engineers, Seattle District. The NCMA in each test sediment was compared against that in the reference sediment. An arcsine square root transformation was performed on percentage data before analysis. Following determination of normality and homogeneity of variances, a one-tailed Student T-test, Approximate T-test, One-sample T-test, Mann Whitney test, or Rankit Analysis was conducted at the 0.10 level of significance.

### PROTOCOL DEVIATIONS

1. Larvae were exactly two hours old at test initiation, very slightly in exceedance of the protocol-specified <2 hours.

### REFERENCE TOXICANT TEST

The routine reference toxicant test is a standard multi-concentration toxicity test using copper as  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  to evaluate the performance of the test organisms used in the sediment toxicity test. The performance is evaluated by comparing the results of this test with historical results obtained at the laboratory. A summary of the reference toxicant test result is given below. The reference toxicant test raw data are found in Appendix II. The reference toxicant test is conducted following EPA/600/R-95/136 (Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms, August 1995).

Test No.: 999-2078

Reference Toxicant and Source: Copper as  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , Argent Lot #0195, 1.0 mg/ml stock prepared 3-24-04.

Test Date: 2-21-06

Dilution Water Used: Yaquina Bay, Oregon, seawater at 30.0‰

Result: 48-hr EC50, 8.96  $\mu\text{g Cu/L}$ . This result is within the laboratory's control chart  $\pm 2$  SD warning limits (7.03 to 14.1  $\mu\text{g Cu/L}$ ).

### RESULTS AND DISCUSSION

Observations of water quality parameters during the test are summarized in Table 1. Individual water quality measurements are located in the raw data (Appendix II).

The measurements of standard water quality parameters were all within protocol specified ranges (Table 1). Sulfides were not detected in the overlying bioassay water (detection limit 0.1 mg/L). Total ammonia-N ranged from 0.1 mg/L to 1.0 mg/L.

Means and standard deviations of the number normal and the normalized combined percent mortality and abnormality (NCMA) endpoint for sediments are summarized in Table 2. Detailed data organized by sample and replicate, including the larval counts, for all calculated endpoints are given in Appendix II. A total of five replicate subsamples were recounted (QC counts) as a check on the acceptability of the initial counts (Appendix II). In all instances the QC counts were close (coefficients of variation from 0 to 14 for counts of normal larvae) to the initial counts and were considered acceptable.

The test met the control acceptance criterion of  $\geq 70\%$  normal in the seawater control; the control mean percent normality was 99.2%. The mean seawater-normalized combined mortality and abnormality (NCMA) values in



reference sediments REF-EBB and REF-YB were 61.8% and 52.0%, respectively, which did not meet the DMMP criterion of  $\leq 35\%$ . REF-EBB was used for statistical comparisons, by direction of the client.

The test control acceptance criterion was met, and positive control performance was within the laboratory's acceptance limits. However, since the reference sediment performance criterion was not met, it is concluded that the test has developed provisionally acceptable data for use in making management decisions.

NCMA in test sediments SD-100, SD-101, SD-103, and SD-104 was significantly greater than that in reference sediment REF-EBB (Table 2).

Interpretation was based on guidelines from the "Dredged Material Evaluation and Disposal Procedures, A User's Manual for the Puget Sound Dredged Disposal Analysis (PSDDA) Program," February 2000 (U.S. Army Corps of Engineers, Seattle District; U.S. Environmental Protection Agency, Region 10, Washington Department of Natural Resources, Washington Department of Ecology). For a test sediment to fail under these guidelines, under the single hit rule, the mean NCMA must be  $>20\%$ , and  $15\%$  (dispersive) or  $30\%$  (nondispersive) absolute over the mean reference sediment NCMA, and statistically different from the reference ( $\alpha = 0.10$ ).

All test sediments but SD-102 failed under the single-hit rule for dispersive sites, and none of the test sediments failed for nondispersive sites. However, the interpretation was complicated by poor reference sediment performance.

#### STUDY APPROVAL

Michelle J. Redmond 6-13-06  
Project Manager Date

Richard J. Caldwell 6/13/06  
Laboratory Director Date

Michelle J. Redmond for  
Gerald J. Drissarri 6-13-06  
Study Director Date

Julie R. Fiore for  
Linda Nemeth 6-14-06  
Quality Assurance Unit Date

Table 1. Summary of water quality conditions during the tests of mussel, *Mytilus galloprovincialis*, larvae exposed to marine sediments.

Parameter	Mean $\pm$ SD	Minimum	Maximum	N
Temperature ( $^{\circ}$ C)	15.7 $\pm$ 0.4	15.0	16.1	24
pH	7.7 $\pm$ 0.1	7.5	7.9	24
Salinity (‰)	27.5 $\pm$ 0.5	27.0	28.5	24
Dissolved Oxygen (mg/L)	7.6 $\pm$ 0.5	6.4	8.1	24
Dissolved Sulfide (mg/L)	---	<0.1	<0.1	16
Total Ammonia-N (mg/L)	---	0.1	1.0	16

Table 2. Means and standard deviations (n=5) of number normal larvae and NCMA (combined mortality and abnormality, normalized to the seawater control) of mussel, *Mytilus galloprovincialis*, larvae exposed to marine sediments. An "\*" indicates that the NCMA in a test sediment was significantly higher than that in reference sediment REF-EBB ( $p < 0.10$ ).

Sample Description	Number normal larvae	Normalized combined percent mortality & abnormality (NCMA)
Seawater control	229 $\pm$ 16	0.0 $\pm$ 7.1
REF-EBB (NAS #0426G) <sup>1</sup>	88 $\pm$ 34	61.8 $\pm$ 15.0
REF-YB (NAS #0427G) <sup>1</sup>	110 $\pm$ 58	52.0 $\pm$ 25.3
SD-100 (NAS #0421G)	45 $\pm$ 38	80.2 $\pm$ 16.7 *
SD-101 (NAS #0422G)	29 $\pm$ 24	87.3 $\pm$ 10.6 *
SD-102 (NAS #0423G)	100 $\pm$ 64	56.4 $\pm$ 28.0
SD-103 (NAS #0424G)	48 $\pm$ 21	79.1 $\pm$ 9.1 *
SD-104 (NAS #0425G)	53 $\pm$ 20	77.1 $\pm$ 8.5 *

<sup>1</sup> REF-EBB was used as the reference sediment; REF-YB was not used for statistical comparisons.

Table 3. Single-hit criteria interpretation of *Mytilus* larval sediment bioassay data. REF-EBB was used as the reference sediment.

Sample description	Normalized combined mortality & abnormality (%)	Significantly different from REF-EBB at $\alpha = 0.10$ ?	Percent difference (greater) from REF-EBB	Failure under 1-hit dispersive rule?	Failure under 1-hit nondispersive rule?
Seawater control	$0.0 \pm 7.1$	---	---	---	---
REF-EBB (NAS #0426G) <sup>1</sup>	$61.8 \pm 15.0$	---	---	---	---
REF-YB (NAS #0427G) <sup>1</sup>	$52.0 \pm 25.3$	---	---	---	---
SD-100 (NAS #0421G)	$80.2 \pm 16.7$	YES	18.4	YES	NO
SD-101 (NAS #0422G)	$87.3 \pm 10.6$	YES	25.5	YES	NO
SD-102 (NAS #0423G)	$56.4 \pm 28.0$	NO	-5.4	NO	NO
SD-103 (NAS #0424G)	$79.1 \pm 9.1$	YES	17.3	YES	NO
SD-104 (NAS #0425G)	$77.1 \pm 8.5$	YES	15.3	YES	NO

<sup>1</sup> REF-EBB was used as the reference sediment; REF-YB was not used for statistical comparisons.

**APPENDIX I**  
**PROTOCOL**

## TEST PROTOCOL

### BIVALVE LARVAL SEDIMENT BIOASSAY

#### 1. INTRODUCTION:

- 1.1 Purpose of Study: The purpose of this study is to identify test sediments that are toxic to bivalve larvae.
- 1.2 Summary of Method: The 48- to 60-hr static test is performed using newly fertilized embryos of the Pacific oyster, Crassostrea gigas or blue mussel, Mytilus sp. Eighteen grams of test sediment suspended in 900 mL of test water are vigorously mixed for 10 sec in the 1 L glass test vessels to produce the test medium. After 4 hr, the test containers are inoculated with <2-hr-old embryos at a level sufficient to yield a final concentration of 20-40 per ml. Five replicates are used for each treatment, reference, and control sediment (A sixth replicate is used only for water quality measurements). Mortality, abnormal development, and combined mortality/abnormality during exposure are the response criteria used. The mean  $\pm$  S.D. for each treatment and test endpoint is given in the final report. Between-treatment comparisons may be made with Student's t-test, or by using an analysis of variance with an appropriate post-hoc test.

#### 2. STUDY MANAGEMENT:

- 2.1 Sponsor's Name and Address:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 2.2 Sponsor's Study Monitor:  
\_\_\_\_\_
- 2.3 Name of Testing Laboratory:  
Northwestern Aquatic Sciences  
Yaquina Bay Road  
P.O. Box 1437  
Newport, OR 97365
- 2.4 Test Location: \_\_\_\_\_
- 2.5 Laboratory's Personnel to be Assigned to the Study:  
Project Manager/Technical Director: \_\_\_\_\_  
Qual. Assurance Officer: \_\_\_\_\_  
Aquatic Biologist: \_\_\_\_\_  
Aquatic Biologist: \_\_\_\_\_
- 2.6 Proposed Testing Schedule: Tests to begin within 2 weeks (8 weeks if held under nitrogen for PSDDA) of sample collection. Reference toxicant test to be run concurrently.
- 2.7 Good Laboratory Practices: Tests are conducted according to Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

#### 3. TEST MATERIAL

The test materials are marine sediments. The collected sediments are placed in solvent and acid cleaned 1 L glass jars fitted with TFE-lined screw caps. Samples are stored at 4°C in the dark for up to 14 days. For PSDDA testing, the samples may be stored under nitrogen at 4°C in the dark in the original sealed containers for up to 8 weeks prior to testing. In addition to the test sediments, one or more reference sediments (a clean sediment with physical characteristics similar to the test sediments), must be employed. A second control sediment from a clean site may also be used (optional).

#### 4. TEST WATER

Test water is filtered Yaquina Bay seawater adjusted to a salinity of 28 ppt. The water is pumped daily from Yaquina Bay into a 6000 gal seasoned fiberglass reservoir from which it is supplied under pump pressure to the laboratory. Filtration is accomplished using a sand filter followed by a medium porosity (10-25 um) cartridge filter, then a £ 0.45 um filter. An alternative seawater supply of similar quality may be used. The use of sterile seawater may be desirable.

#### 5. TEST ORGANISMS

5.1 Species: Pacific oyster, Crassostrea gigas or blue mussel Mytilus sp.

5.2 Source: Adult oysters are purchased from Oregon Oyster Co., Newport, OR, a commercial grower. Blue mussels are purchased from a commercial supplier such as Carlsbad Aquafarms, Carlsbad, CA.

5.3 Age at Study Initiation: Less than two-hour-old embryos.

5.4 Conditioning/Acclimation of Adults: Adult bivalves are conditioned/acclimated by holding for up to eight weeks in seasoned fiberglass water trays supplied with a minimum of 1 L/min of unfiltered Yaquina Bay, OR water (22-32 ppt) at a temperature of approximately 18-22°C (14-18°C for mussels). Supplemental feeding with cultured algae may be desirable. A 14 hour/10 hour light-dark photoperiod is employed.

5.5 Spawning and Fertilization: Adult bivalves are cleaned by brushing and placed into spawning trays supplied with seawater. The bivalves are spawned by gradually increasing the water temperature to 5-10°C above the conditioning temperature over approximately a one hour period. Sperm from a sacrificed male may be added to the spawning tray to aid stimulation of natural spawning. If spawning does not occur, the water is cooled and the cycle is repeated. Bivalves that begin spawning are rinsed and isolated in clean sterile seawater for collection of gametes.

Eggs from two or more females are fertilized by addition of sperm from two or more males at a concentration of  $10^5$  to  $10^7$ /ml. After fertilization, the embryo density is adjusted to approximately 2000-4000/ml by dilution with 28 ppt seawater. Embryos are kept suspended by frequent gentle agitation with a perforated plunger and the temperature is maintained at test temperature. The quality of the embryos is verified before testing by microscopic examination. Less than 2-hr-old embryos are used in the test.

#### 6. DESCRIPTION OF TEST SYSTEM

6.1 Test Chambers and Environmental Control: Test chambers used in the toxicity test are covered 1 L glass beakers. Test chambers are maintained at constant temperature by partial immersion in a temperature-controlled water bath or placement in a temperature-controlled environmental chamber. Aeration is generally recommended but not required by PSEP unless dissolved oxygen falls below 60% saturation. Aeration is required for PSDDA. The test is performed under a 14:10 L:D photoperiod with illumination supplied by fluorescent lamps.

6.2 Cleaning: All laboratory glassware, including test chambers, is cleaned as described in EPA/600/4-90/027. (NAS SOP No. G-1.) New glassware and test systems are soaked 15 minutes in tap water and scrubbed with detergent (or cleaned in automatic dishwasher); rinsed twice with tap water; carefully rinsed once with fresh, dilute (10%, V:V) hydrochloric or nitric acid to remove scale, metals, and bases; rinsed twice with deionized water; rinsed once with acetone to remove organic compounds (using a fume hood or canopy); and rinsed three times with deionized water. Test systems and chambers are rinsed again with dilution water just before use.

## 7. EXPERIMENTAL DESIGN AND TEST PROCEDURES

7.1 Experimental Design: The experimental design consists of exposure of bivalve embryos to a number of test sediments, one or more reference sediments, a clean sand control sediment (optional), and a no-sediment (seawater) control. Each treatment consists of five replicate test containers, each containing from 20,000 to 40,000 bivalve embryos. A sixth replicate series is used for water quality measurements. Complete randomization of test containers is used.

7.2 Test Procedure: Eighteen grams of test or control sediment is added to the appropriate 1 L test container and the test water is added to a final volume of 900 mL. The containers are vigorously mixed for 10 seconds and then allowed to settle for 4 hr. Each test vessel is then inoculated with 20,000 to 40,000 <2-hr-old bivalve embryos (~ 1 ml of embryo stock). The embryos are incubated at  $20 \pm 1^\circ\text{C}$  for oysters ( $16 \pm 1^\circ\text{C}$  for mussels) for 48-60 h to permit development into normal prodissoconch I stage larvae. Immediately after inoculation of the test vessels with embryos, 10 ml aliquots are removed from each of the five no-sediment control replicates and preserved in 5% buffered formalin. These are counted at a later date to establish the average initial embryo concentration.

The test is terminated after 48-60 hr by carefully decanting the supernatant liquid into a 1000 ml beaker. Ten milliliter aliquots are then taken from each beaker, placed into a 30 ml glass vial, and preserved in 5% buffered formalin. The beaker contents are gently agitated using a perforated plastic plunger at the time of aliquot removal to ensure that the aliquots accurately reflect the embryo/larval concentration of the entire test vessel. Larvae are subsequently counted in the 30 ml vials using an inverted compound microscope to determine the total number of larvae and the number failing to develop a complete shell; these data are used for calculating the percent mortality, percent abnormality, and percent combined mortality and abnormality (percent abnormal/dead). Approximately 10% of the samples may be counted by a second investigator as a QA/QC measure.

7.3 Effect Criteria: Effect criteria are: 1) mortality of the embryos, and 2) abnormal development (failure to produce completely developed shells). A third effect expression is a combination of these two, percent abnormal/dead. This is functionally equivalent to percent normal.

The initial number of embryos are determined by averaging the counts of all eggs in initial subsamples of the five seawater control test containers. Live abnormal larvae are those observed at 48-60 hr in which a fully shelled, straight-hinged, D-shaped prodissoconch I stage has been reached.

7.4 Test Conditions: The test exposure duration is 48-60 h. The test temperature is  $20 \pm 1^\circ\text{C}$  for oysters and  $16 \pm 1^\circ\text{C}$  for mussels. The salinity is  $28 \pm 1$  ppt. The photoperiod is a 14:10 hr, L:D cycle of fluorescent light. Aeration is not required for PSEP unless dissolved oxygen falls below 60% saturation; aeration is required for PSDDA (dissolved oxygen must be maintained at  $\geq 4$  mg/L). Test chambers are 1 L glass beakers held in a controlled temperature environment.

7.5 Feeding: Embryos are not fed during the test.

7.6 Test Duration, Type and Frequency of Observations, and Methods: The test duration is 48-60 hours. The type and frequency of observations to be made during the test are summarized as follows:

Type of Observation

Times of Observation

Biological Data

Mortality and abnormal development

End of test (at 48-60 hours)

Physical and Chemical Data

Temperature, dissolved oxygen,

salinity, & pH

Ammonia-N and sulfide

Daily in water quality beakers

Beginning & end of test in

water quality beakers

Temperature is measured with a calibrated mercury thermometer or telethermometer. Dissolved oxygen is directly measured in test vessels using a polarographic oxygen probe calibrated according to the manufacturer's recommendations. Salinity is measured using a refractometer. The pH is measured with a pH probe and a calibrated meter with scale divisions of 0.1 pH units. Ammonia-N is measured using the HACH Model FF-3 test kit (ammonia-N detection limit 0.1 mg/L). Sulfide is measured using the HACH Hydrogen Sulfide Test Kit Model HS-WR (sulfide detection limit 0.01 mg/L).

- 7.7 Criteria of Test Acceptance: The test results are acceptable if at least 70% of the seawater control larvae achieve a normal, D-shaped prodissoconch I stage. Also, for PSDDA, effects in the reference sediments must be  $\leq 35\%$  over the seawater control.

8. DATA ANALYSIS METHODS

Prior to issuance of the July 1995 revision of the PSEP recommended guidelines for conducting laboratory bioassays, no specific guidance was given for the computation of endpoints. All three standard endpoints, percent abnormal, percent combined mortality/abnormality, and percent mortality have occasionally been computed both with, and without, normalization for the seawater control. In order to be consistent with what we assume to be the PSAMP format, all endpoints given in reports are usually the non-normalized endpoints. In addition, normalized percent mortality (NPM), and normalized combined mortality/abnormality (NCMA) are computed and are included in the raw data computer printouts. The formulas employed for each of these computations are as follows:

$$\text{PABN (Percent Abnormality)} = 100 \cdot (A/T)$$

$$\text{PABND (Combined Percent Mortality/Abnormality)} = 100 \cdot ((I-N)/I)$$

$$\text{PMORT (Percent Mortality)} = 100 \cdot ((I-T)/I)$$

$$\text{NPM (Normalized Percent Mortality)} = 100 \cdot (1 - (T/TS))$$

$$\text{NCMA (Normalized Combined Percent Mortality/Abnormality)} = 100 \cdot (1 - (N/NS))$$

where the following are counts per 10 ml subsample:

N = normal larvae counted

A = abnormal larvae counted

T = N+A (total larvae counted)

I = number of inoculated embryos (from average of zero time counts)

TS = average of total larvae counted in seawater controls

NS = average of normal larvae counted in seawater controls

Other endpoints may be computed at client request.

The means and standard deviation are then calculated for each treatment level. Between-treatment comparisons for each biological endpoint may be made using a t-test or a one-way analysis of variance F test (Snedecor and Cochran 1967). An arcsine square root data transformation is required for proportional data.



9. REPORTING

A standard NAS report of the test results must include the following information: name and identification of the test; the investigator and laboratory; sediment holding temperature data; information on the test sediment including the interstitial salinity; information on the source of seawater used; detailed information about the test organisms including acclimation conditions; a description of the experimental design and test chambers and other test conditions including water quality; information about any aeration that may have been required; definition of the effect criteria and other observations; unusual responses, if any, in the control treatment; individual replicate and mean and S.D. data for larval mortality after 48-60 hr; individual replicate and mean and S.D. data for larval abnormalities after 48-60 hr; individual replicate and mean and S.D. data for combined abnormality and mortality; 48-hr LC50 and EC50 with reference toxicant; a description of data analysis methods and documentation of statistical test results; any unusual information about the test or deviations from procedures.

10. STUDY DESIGN ALTERATION

Amendments made to the protocol must be approved by the sponsor and study director and should include a description of the change, the reason for the change, the date the change took effect, and the dated signatures of the study director and sponsor. Any deviations in the protocol must be described and recorded in the study raw data.

11. REFERENCE TOXICANT

Reference toxicant testing should be included with each study or at regular intervals as defined in the Quality Assurance Program of the laboratory.

12. REFERENCED GUIDELINES

ASTM. 1989. Standard guide for conducting static acute toxicity tests with embryos of four species of saltwater bivalve molluscs. ASTM Standard Method No. E 724-89. Am. Soc. Test. Mat., Philadelphia, PA.

PSDDA. 1990. Summary and conclusions of the Puget Sound Dredged Disposal Analysis (PSDDA) Bioassay Workshop, memorandum for the record. U.S. Army Corps of Engineers, Seattle District.

Puget Sound Estuary Program. 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Prepared for U.S. Env. Prot. Agency, Region 10, Office of Puget Sound, Seattle, WA and Puget Sound Water Quality Authority, P.O. Box 40900, Olympia, WA.

Snedecor, G.W. and W.G. Cochran. 1967. Statistical methods. Sixth ed., The Iowa State Univ. Press. Ames, Iowa., 593 pp.

Weber, C.I. (Ed.) 1991. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fourth Edition). EPA/600/4-90/027.

13. APPROVALS

\_\_\_\_\_  
Name Date for \_\_\_\_\_

\_\_\_\_\_  
Name Date for Northwestern Aquatic Sciences

## **APPENDIX II**

### **RAW DATA**

**TEST DESCRIPTION, MONITORING, AND RESULTS  
BENCHSHEETS**

## SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3 Client Kennedy/Jenks

Investigator

*revised**pg. 1-27 MR**6-13-06*

## STUDY MANAGEMENT

Client: Kennedy/Jenks Consultants, 200 S.W. Market St., Suite 500, Portland, OR 97201Client's Study Monitor: Dr. Taku FujiTesting Laboratory: Northwestern Aquatic SciencesTest Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir. M.S. Redmond *MR* G.J. Irissari *GI*QA Officer L.K. Nemeth1. Susan Gage *SG*2. Bell Montgomerie *BM*3. R.S. Caldwell *RC*4. Greg Hutchinson *GH*5. G.A. Buhler *GB*6. 

Study Schedule:

Test Beginning: 2-21-06 1420Test Ending: 2-23-06 1600

## TEST MATERIAL

General description (see sample logbook/chain-of-custody for details):

NAS Sample No.:	0421G	0422G	0423G	0424G	0425G
Description:	SD-100	SD-101	SD-102	SD-103	SD-104
Collection Date:	1/26/06	1/26/06	1/26/06	1/26/06	1/26/06
Receipt Date:	1/27/06	1/27/06	1/27/06	1/27/06	1/27/06
Inters. Salinity (ppt):	<u>1.5</u>	<u>3.0</u>	<u>1.0</u>	<u>4.5</u>	<u>5.0</u>

NAS Sample No.:	0426G	0427G			
Description:	REF-EBB	REF-YB			
Collection Date:	1/26/06	1/26/06			
Receipt Date:	1/27/06	1/27/06			
Inters. Salinity (ppt):	<u>5.0</u>	<u>7.0</u>			

NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
Inters. Salinity (ppt):					

NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
Inters. Salinity (ppt):					

Error codes: 1) correction of handwriting error

2) written in wrong location; entry deleted

3) wrong date deleted, replaced with correct date

4) error found in measurement; measurement repeated

Test No. 738-3 Client Kennedy/Jenks Investigator \_\_\_\_\_

[illegible]

## SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3 Client Kennedy/Jenks Investigator \_\_\_\_\_

## TEST ORGANISMS

Species: Mytilus galloprovincialisDate Received: 2-15-06Source: Carlsbad Aquafarm, Carlsbad, CA

## Acclimation Data:

Date	Temp. (deg.C)	DO (mg/L)	pH	Sal (ppt)	DO (mg/L)	Comments
2-6-06	9.0	9.6	7.9	26.5		Held outside in trays
2-10-06	9.3	8.6	8.1	28.5		of flowing seawater
2-12-06	11.0	8.3	7.8	31.0		
2-15-06	8.1	11.2	7.8	31.0		
2-17-06	5.1	12.4	8.0	29.5		
2-20-06	4.0	10.0	8.1	33.5		
Mean	7.8	5.7	11.2	10.0	8.0	30.0 31.3
S.D.	2.7	2.1	1.2	1.6	0.1	0.2
(N)	6	3	3	6	3	6

Photoperiod during acclimation: Outdoor ambient conditions

## TEST WATER

Source: Yaquina Bay, Oregon, sea waterDate of Collection: 2-20-06 Salinity (ppt) 28.0 pH 7.9Treatments: filtered to 0.4 µm, salinity-adjusted with MilliQ deionized water, aerated

## SPAWNING AND GAMETE HANDLING

Spawning: Initial: 0910 AM/PM Final: 0935 AM/PM Fertilization: 1220 AM/PMNumber of organisms used: females: 9 males: 4

Egg Dilution (1 ml diluted to 100 ml):

Count/ml of dilution: 1. 46 2. 56 3. 61 Mean: 54Dilution factor = DF (mean x 500/25,000) = 1.1

## TEST PROCEDURES AND CONDITIONS

Test chambers: 1 L glass beakers covered with watchglasses

Test volumes: 18 g of test sediment; 900 ml of test water

Replicates/treatment: (5) 5 Organisms/treatment: (20-40/ml) 23.1

Use 6th replicate/test sediment for water quality and development assessment beaker

Test water changes: None Aeration: yes Feeding: none Photoperiod: 14L:10D

Test temperature (deg.C): mussels 16 oysters 20, echinoderms 15

Beaker placement: Total randomization

Larval stock (20,000-40,000/ml) inoculation volume: 1.0 ml; &lt;2-hr old

Subsample size for counting: 10 ml

## MISCELLANEOUS NOTES

Light intensity measurements:

Date  
2-21-06Location in room  
beaker #16  
#32foot-candles  
100  
87

## SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 783-3 Client Kennedy/Jenks Investigator \_\_\_\_\_Test conducted in (circle one): room 1 room 2 trailer water bath other: ROOM #4Randomization chart: TOP SHELF

3									48
2									47
1									46

Randomization chart:


Randomization chart:


Randomization chart:


Randomization chart:


## SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3Client Kennedy/Jenks

Investigator \_\_\_\_\_

## WATER QUALITY RECORD

Day 0 (2/21/06) AB/AF/64 overlying NH<sub>3</sub> sampled (day 0 and 2)? yes RSC  
 overlying S sampled (day 0 and 2)? yes RSC

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
6	15.2	7.7	27.0	7.6	
19	15.3	7.5	27.0	6.4	
20	15.2	7.6	27.0	6.9	
21	15.2	7.8	27.5	6.6	
25	15.2	7.8	27.0	7.3	
37	15.1	7.6	27.0	6.8	
41	15.0	7.5	27.0	6.8	
42	15.2	7.9	27.0	6.8	

Day 1 (2/22/06) W

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
6	16.0	7.8	27.5	8.0	
19	16.0	7.7	27.5	7.8	
20	16.0	7.7	27.0	8.0	
21	16.1	7.8	27.5	8.1	
25	16.1	7.8	27.5	8.0	
37	15.9	7.7	27.0	7.9	
41	15.9	7.7	28.0	8.0	
42	15.8	7.8	28.5	8.1	

Day 2 (2/23/06) AF overlying NH<sub>3</sub> sampled (day 0 and 2)? yes  
 overlying S sampled (day 0 and 2)? yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
6	15.9	7.8	28.0	8.0	
19	16.1	7.7	27.5	7.8	
20	16.1	7.7	27.5	7.8	
21	16.0	7.8	28.0	7.9	
25	16.0	7.8	27.5	7.9	
37	15.8	7.7	28.0	7.8	
41	15.9	7.7	28.0	7.7	
42	15.8	7.9	28.5	8.0	



Test No. 738-3 Client Kennedy/Jenks Investigator \_\_\_\_\_

## Zero time Cont

[illegible]

Test No. 738-3 Client Kennedy/Jenks Investigator \_\_\_\_\_

3-27-06  
611

Beaker no.	Response	
	N	A
1		
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27		
28	14	81
29	31	88
30	228	89
31	214	11
32	130	21
33		
34		
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36		
37		
38		
39		
40		

[illegible][illegible]

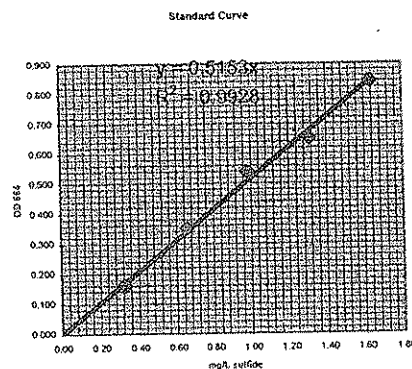
# **Dissolved Sulfide in Water: Computation Worksheet** **Methylene Blue Method (SOP #5550)**

**Standardization**

	1	2	3
uL PAO titrant employed:	98	96	99
Working Std. Conc. (mg/L):		1.63733	

**Result**

Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank	-----	-----	-----
1.0 mL working sulfide std.	-----	0.160	0.33
2.0 mL working sulfide std.	-----	0.350	0.65
3.0 mL working sulfide std.	-----	0.540	0.98
4.0 mL working sulfide std.	-----	0.650	1.31
5.0 mL working sulfide std.	-----	0.840	1.64
3.0 mL spike	-----	0.530	1.03
3.0 mL spike dupl.	-----	0.522	1.01



1.	6	5	0.002	ND
2.	19	5	0.004	ND
3.	20	5	0.000	ND
4.	21	5	0.001	ND
5.	25	5	0.000	ND
6.	37	5	0.004	ND
7.	41	5	0.002	ND
8.	42	5	0.000	ND

Reporting limit (mg/L) = 0.1

Recovery (%) = 103.8

Precision (RPD) = 1.52

Sample volume (ml): 1.00

Dilution factor 5

**Sample Set Description:**

Test No.: 738-3

Test Day: 0 (2-21-06)

Species: *Mytilus*

overlying water

Analyst: RSC

Date analysed: 2/21/2006

# **Dissolved Sulfide in Water: Computation Worksheet** **Methylene Blue Method (SOP #5550)**

**Standardization**

uL PAO titrant employed:

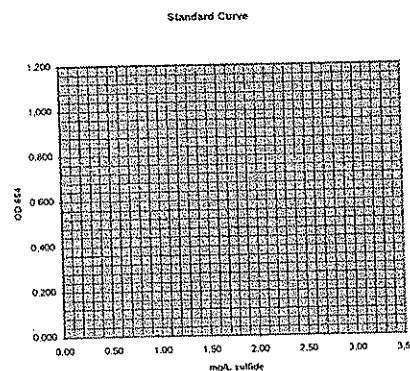
1      2      3  
 17    26    44

Working Std. Conc. (mg/L):

3.2

**Result**

Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank	---	---	---
1.0 mL working sulfide std.	---	160	0.64
2.0 mL working sulfide std.	---	320	1.28
3.0 mL working sulfide std.	---	480	1.92
4.0 mL working sulfide std.	---	640	2.56
5.0 mL working sulfide std.	---	800	3.20
3.0 mL spike	---	530	---
3.0 mL spike dupl.	---	522	---



1.	6.	5	302
2.	19	5	304
3.	20	5	300
4.	21	5	301
5.	25	5	300
6.	37	5	304
7.	41	5	302
8.	42	5	300

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 1.00  
 Dilution factor: 5

**Sample Set Description:**

Test No.: 738-3

Test Day: 0 (2-21-06)

Species: *Mytilus*

overlying water

Analyst: RSC  
 Date analysed: 2/21/2006

# Dissolved Sulfide in Water: Computation Worksheet Methylene Blue Method (SOP #5550)

## Standardization

uL PAO titrant employed:

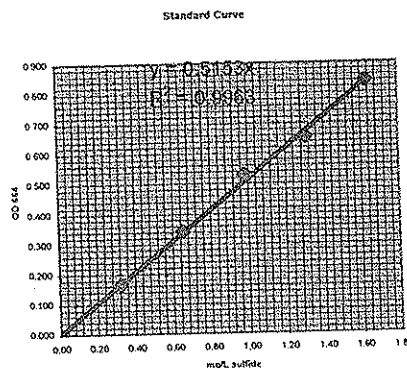
	1	2	3
uL PAO titrant employed:	98	100	96

Working Std. Conc. (mg/L):

1.632

## Result

Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank			
1.0 mL working sulfide std.		0.167	0.33
2.0 mL working sulfide std.		0.342	0.65
3.0 mL working sulfide std.		0.530	0.98
4.0 mL working sulfide std.		0.655	1.31
5.0 mL working sulfide std.		0.838	1.63
3.0 mL spike		0.525	1.02
3.0 mL spike dupl.		0.515	1.00



1.	6	5	0.003	ND
2.	19	5	0.007	ND
3.	20	5	0.000	ND
4.	21	5	0.001	ND
5.	25	5	0.001	ND
6.	37	5	0.000	ND
7.	41	5	0.002	ND
8.	42	5	0.004	ND

Reporting limit (mg/L) = 0.1

Recovery (%) = 103.0

Precision (RPD) = 1.92

Sample volume (ml): 1.00  
Dilution factor: 5

## Sample Set Description:

Test No.: 738-3

Test Day: 2 (2-23-06)

Species: *Mytilus*

overlying water

Analyst: RSC  
Date analysed: 2/23/2006

# **Dissolved Sulfide in Water: Computation Worksheet** **Methylene Blue Method (SOP #5550)**

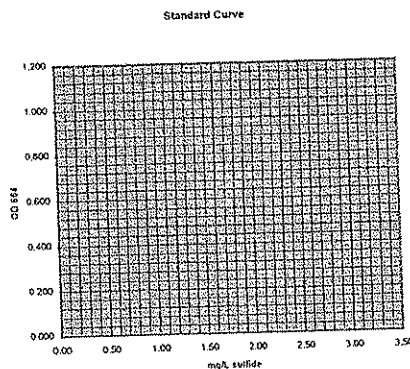
**Standardization**

1 2 3  
 uL PAO titrant employed: 45 100 96

Working Std. Conc. (mg/L): 3.2

**Result**

Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank	---	---	---
1.0 mL working sulfide std.	---	0.167	0.64
2.0 mL working sulfide std.	---	0.334	1.28
3.0 mL working sulfide std.	---	0.500	1.92
4.0 mL working sulfide std.	---	0.667	2.56
5.0 mL working sulfide std.	---	0.833	3.20
3.0 mL spike	---	0.833	---
3.0 mL spike dupl.	---	0.833	---



1.	6.	5	0.003
2.	19	5	0.007
3.	20	5	0.008
4.	21	5	0.009
5.	25	5	0.011
6.	37	5	0.016
7.	41	5	0.018
8.	42	5	0.019
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Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 1.00  
 Dilution factor: 5

**Sample Set Description:**

Test No.: 738-3

Test Day: 2 (2-23-06)

Species: *Mytilus*

overlying water

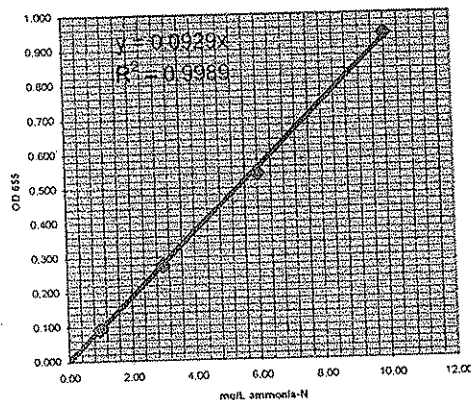
Analyst: RSC  
 Date analysed: 2/23/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	-----	-----	-----
1.0 mg/L NH <sub>3</sub> -N Std.	-----	0.092	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	-----	0.275	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	-----	0.540	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	-----	0.940	10.00
3.0 mg/L spike	-----	0.282	3.04
3.0 mg/L spike dupl.	-----	0.276	2.97
5.0 mg/L 2nd source	-----	0.430	4.63
1. 6	1	0.080	0.86
2. 19	1	0.089	0.96
3. 20	1	0.031	0.33
4. 21	1	0.077	0.83
5. 25	1	0.072	0.78
6. 37	1	0.080	0.86
7. 41	1	0.048	0.52
8. 42	1	0.021	0.23
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Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = 100.1

Precision (RPD) = 2.15

2nd source (%) = 92.6

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No: 738-3

Test Day: 0 (2-21-06)

Species: *Mytilus*

Overlying water

Analyst:

Date analysed:

RSC

2/21/2006

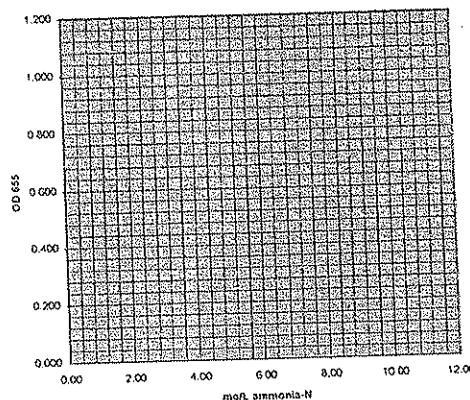
# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	----	----	----
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.92	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	----	2.75	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	----	5.40	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	----	9.10	10.00
3.0 mg/L spike	----	2.72	
3.0 mg/L spike dupl.	----	2.76	
5.0 mg/L 2nd source	----	4.30	

1.	6	1	0.80
2.	19	1	0.89
3.	20	1	0.31
4.	21	1	0.77
5.	25	1	0.72
6.	37	1	0.80
7.	41	1	0.48
8.	42	1	0.21
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36.			

Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!  
 Precision (RPD) = #VALUE!  
 2nd source (%) = #VALUE!

Sample volume (ml): 0.50  
 Dilution factor: 1

**Sample Set Description:**

Test No.: 738-3  
 Test Day: 0 (2-21-06)  
 Species: *Mytilus*

Overlying water

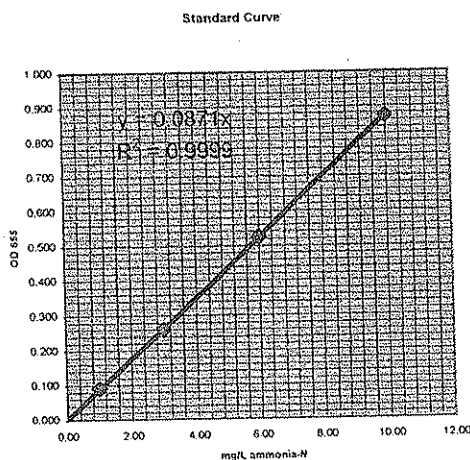
Analyst: RSC  
 Date analysed: 2/21/2006



# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank			
1.0 mg/L NH <sub>3</sub> -N Std.		0.091	1.00
3.0 mg/L NH <sub>3</sub> -N Std.		0.260	3.00
6.0 mg/L NH <sub>3</sub> -N Std.		0.525	6.00
10.0 mg/L NH <sub>3</sub> -N Std.		0.870	10.00
3.0 mg/L spike		0.270	3.10
3.0 mg/L spike dupl.		0.278	3.19
5.0 mg/L 2nd source		0.433	4.97



1.	6	1	0.050	0.57
2.	19	1	0.062	0.71
3.	20	1	0.017	0.20
4.	21	1	0.048	0.55
5.	25	1	0.049	0.56
6.	37	1	0.056	0.64
7.	41	1	0.022	0.25
8.	42	1	0.010	0.11

Reporting limit (mg/L) = 0.1

Recovery (%) = 104.8

Precision (RPD) = -2.92

2nd source (%) = 99.4

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 738-3

Test Day: 2 (2-23-06)

Species: *Mytilus*

Overlying water

Analyst:

RSC

Date analysed:

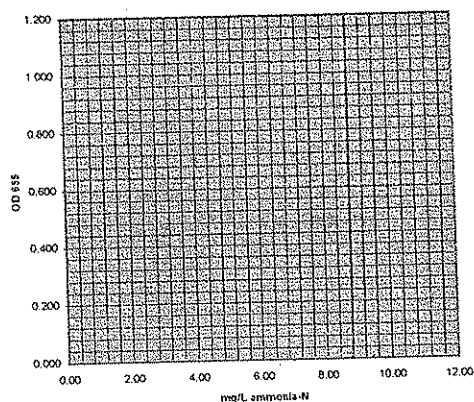
2/23/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	0.91	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	2.60	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	5.25	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	8.70	10.00
3.0 mg/L spike	---	2.70	
3.0 mg/L spike dupl.	---	2.78	
5.0 mg/L 2nd source	---	4.33	
1. 6	1	0.50	
2. 19	1	0.62	
3. 20	1	0.17	
4. 21	1	0.48	
5. 25	1	0.49	
6. 37	1	0.56	
7. 41	1	0.22	
8. 42	1	0.10	
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Standard Curve



Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor: 1

**Sample Set Description:**

Test No.: 738-3

Test Day: 2 (2-23-06)

Species: *Mytilus*

Overlying water

Analyst: RSC

Date analysed: 2/23/2006

# Carlsbad Aquafarms, LLC

# Invoice

Mail: P.O. Box 2600 92018  
4600 Carlsbad Blvd.  
Carlsbad, CA 92008  
760 438 2444

DATE	INVOIC...
2/13/2006	7627

**BILL TO:**

Northwestern Aquatic Sciences  
P.O. Box 1437  
Newport, Oregon 97365  
Phone 541-265-7225  
Fax 541-265-2799

**SHIP TO:**

Northwestern Aquatic Sciences  
3814 Yaquina Bay Road  
Newport, Oregon 97365  
FedX 097240973  
UPS 849169

P.O. #	TERMS	SHIP DA...	SHIP VIA	F.O.B.	AIRBILL #
	Net 30	2/14/2006	FEDX	S.D.	854303881255
QUANTI...	ITEM	DESCRIPTION		PRICE LBS.	AMOUNT
1	Bio Assay Mus	Mytilus Gallo Provincialis		125.00	125.00
1	BOX CHARGE			10.00	10.00
Received by WTM 2-15-06					

THIS IS YOUR INVOICE

Total \$135.00

**TEST DATA ANALYSIS RECORDS**

Larval Sediment Test  
Randomization Key

2/13/06

	NAS	CLIENT		
BKR	SMPL	DESCRIP	REPL	
35	swcontrol	swcontrol	1	
31	swcontrol	swcontrol	2	
30	swcontrol	swcontrol	3	
45	swcontrol	swcontrol	4	
48	swcontrol	swcontrol	5	
42	swcontrol	swcontrol	6	wq replicate
18	0421G	SD-100	1	
2	0421G	SD-100	2	
10	0421G	SD-100	3	
38	0421G	SD-100	4	
12	0421G	SD-100	5	
41	0421G	SD-100	6	wq replicate
28	0422G	SD-101	1	
7	0422G	SD-101	2	
15	0422G	SD-101	3	
4	0422G	SD-101	4	
46	0422G	SD-101	5	
19	0422G	SD-101	6	wq replicate
33	0423G	SD-102	1	
16	0423G	SD-102	2	
23	0423G	SD-102	3	
27	0423G	SD-102	4	
34	0423G	SD-102	5	
20	0423G	SD-102	6	wq replicate
13	0424G	SD-103	1	
26	0424G	SD-103	2	
9	0424G	SD-103	3	
43	0424G	SD-103	4	
22	0424G	SD-103	5	
37	0424G	SD-103	6	wq replicate
8	0425G	SD-104	1	
40	0425G	SD-104	2	
5	0425G	SD-104	3	
47	0425G	SD-104	4	
24	0425G	SD-104	5	
6	0425G	SD-104	6	wq replicate
36	0426G	REF-EBB	1	
29	0426G	REF-EBB	2	
14	0426G	REF-EBB	3	
39	0426G	REF-EBB	4	
44	0426G	REF-EBB	5	
25	0426G	REF-EBB	6	wq replicate
3	0427G	REF-YB	1	
11	0427G	REF-YB	2	
32	0427G	REF-YB	3	
1	0427G	REF-YB	4	
17	0427G	REF-YB	5	
21	0427G	REF-YB	6	wq replicate

Endpoints Data Entry and Calculations File

Endpoints Data Entry and															
BKR=beaker number		INIT=number of inoculated embryos (from average of zero-time counts)		zero counts											
				a		221									
NORM=number normal				b		241									
ABN=number abnormal				c		254									
TOTAL=NORM+ABN				d		206									
PMORT=percent mortality=100((INIT-TOTAL)/INIT)				e		233									
PABN=percent abnormality=100(ABN/TOTAL)				Mean =		231									
PABND=combined percent mortality and abnormality=100((INIT-NORM)/INIT)															
NPM=normalized percent mortality=100(1-(TOTAL/TS)),															
where TS=average of total larvae counted in seawater controls															
NCMA=normalized combined percent mortality and abnormality=100(1-(NORM/NS)),															
where NS=average of normal larvae counted in seawater controls															
								</							

INDEX	BKR	NAS	CLIENT	REPL	INIT	NORM	ABN	TOTAL	PMORT	PABN	PABND	NPM	NCMA		NORM	PMORT	PABN	PABND	NPM	NCMA
18	19	0422G	SD-101	6 wq replicate	231															
19	33	0423G	SD-102	1	231	40	103	143	38.1	72.0	82.7	40.4	82.5		Mean	100.0	26.4	44.4	56.7	29.1
20	16	0423G	SD-102	2	231	121	40	161	30.3	24.8	47.6	32.9	47.2		S.D.	64.1	14.5	28.1	27.7	13.9
21	23	0423G	SD-102	3	231	42	94	136	41.1	69.1	81.8	43.3	81.7		n	5	5	5	5	5
22	27	0423G	SD-102	4	231	195	15	210	9.1	7.1	15.6	12.4	14.9							
23	34	0423G	SD-102	5	231	102	98	200	13.4	49.0	55.8	16.6	55.5							
24	20	0423G	SD-102	6 wq replicate	231															
25	13	0424G	SD-103	1	231	74	90	164	29.0	54.9	68.0	31.6	67.7		Mean	47.8	38.7	67.1	79.3	41.0
26	26	0424G	SD-103	2	231	35	86	121	47.6	71.1	84.8	49.5	84.7		S.D.	20.9	10.9	10.8	9.1	10.5
27	9	0424G	SD-103	3	231	43	122	165	28.6	73.9	81.4	31.2	81.2		n	5	5	5	5	5
28	43	0424G	SD-103	4	231	23	87	110	52.4	79.1	90.0	54.1	90.0							
29	22	0424G	SD-103	5	231	64	84	148	35.9	56.8	72.3	38.3	72.1							
30	37	0424G	SD-103	6 wq replicate	231															
31	8	0425G	SD-104	1	231	29	70	99	57.1	70.7	87.4	58.7	87.3		Mean	52.6	43.7	60.0	77.2	45.8
32	40	0425G	SD-104	2	231	39	105	144	37.7	72.9	83.1	39.9	83.0		S.D.	19.6	10.2	11.2	8.5	9.8
33	5	0425G	SD-104	3	231	62	81	143	38.1	56.6	73.2	40.4	72.9		n	5	5	5	5	5
34	47	0425G	SD-104	4	231	79	74	153	33.8	48.4	65.8	36.2	65.5							
35	24	0425G	SD-104	5	231	54	57	111	51.9	51.4	76.6	53.7	76.4							
36	6	0425G	SD-104	6 wq replicate	231															
37	36	0426G	REF-EBB	1	231	130	35	165	28.6	21.2	43.7	31.2	43.3		Mean	87.6	37.7	40.1	62.1	40.0
38	29	0426G	REF-EBB	2	231	38	91	129	44.2	70.5	83.5	46.2	83.4		S.D.	34.3	7.6	19.5	14.9	7.3
39	14	0426G	REF-EBB	3	231	103	34	137	40.7	24.8	55.4	42.9	55.1		n	5	5	5	5	5
40	39	0426G	REF-EBB	4	231	74	54	128	44.6	42.2	68.0	46.6	67.7							
41	44	0426G	REF-EBB	5	231	93	67	160	30.7	41.9	59.7	33.3	59.4							
42	25	0426G	REF-EBB	6 wq replicate	231															
43	3	0427G	REF-YB	1	231	51	67	118	48.9	56.8	77.9	50.8	77.7		Mean	110.0	36.3	29.4	52.4	38.6
44	11	0427G	REF-YB	2	231	50	64	114	50.6	56.1	78.4	52.5	78.2		S.D.	58.0	14.2	25.0	25.1	13.6
45	32	0427G	REF-YB	3	231	133	19	152	34.2	12.5	42.4	36.6	42.0		n	5	5	5	5	5
46	1	0427G	REF-YB	4	231	133	25	158	31.6	15.8	42.4	34.1	42.0							
47	17	0427G	REF-YB	5	231	183	11	194	16.0	5.7	20.8	19.1	20.2							
48	21	0427G	REF-YB	6 wq replicate	231															

Project Name: P738-3 Mytilus larval NCMA

Sample: x1  
 Samp ID: SD-100  
 Alias: NAS #0421G  
 Replicates: 5  
 Mean: 80.18  
 SD: 16.7  
 Tr Mean: 65.193  
 Trans SD: 12.278

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 61.78  
 SD: 14.952  
 Tr Mean: 52.163  
 Trans SD: 9.257

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 7.055 SS: 945.761 K: 5 b: 29.919  Alpha Level: 0.05 Calculated Value: 0.9465 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 10.23 Test Residual SD: 4.464 Ref. Residual Mean: 6.798 Ref. Residual SD: 5.285 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 1.1092 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: ArcSin  Experimental Hypothesis Null: $x_1 \leq x_2$ Alternate: $x_1 > x_2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.1 Calculated Value: 1.8948 Critical Value: $\geq 1.397$ <u>Accept Null Hypothesis: No</u>  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	94.3	76.187	43.3	41.15	10.994	11.014			-16.054
2	86.9	68.781	83.4	65.956	3.587	13.793			-11.014
3	57.2	49.14	55.1	47.927	16.054	4.236			-9.521
4	68.2	55.673	67.7	55.366	9.521	3.203			-4.236
5	94.3	76.187	59.4	50.418	10.994	1.745			-1.745
6									3.203
7									3.587
8									10.994
9									10.994
10									13.793

Data entry verified against EXCEL spreadsheet.  
 Normalized combined percent mortality and abnormality (NCMA) was significantly greater in test sediment SD-100 than in reference sediment REF-EBB at  $\alpha=0.10$ .

*MR 6-5-06*



Project Name: P738-3 Mytilus larval NCMA

Sample: x1  
 Samp ID: SD-101  
 Alias: NAS #0422G  
 Replicates: 5  
 Mean: 87.28  
 SD: 10.633  
 Tr Mean: 70.194  
 Trans SD: 8.481

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 61.78  
 SD: 14.952  
 Tr Mean: 52.163  
 Trans SD: 9.257

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 5.761 SS: 630.5 K: 5 b: 24.63  Alpha Level: 0.05 Calculated Value: 0.9621 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 6.614 Test Residual SD: 4.152 Ref. Residual Mean: 6.798 Ref. Residual SD: 5.285 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 0.0612 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: ArcSin  Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.1 Calculated Value: 3.2113 Critical Value: $\geq 1.397$ Accept Null Hypothesis: No  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	93.9	75.701	43.3	41.15	5.507	11.014			-13.717
2	69.5	56.477	83.4	65.956	13.717	13.793			-11.014
3	93.5	75.229	55.1	47.927	5.035	4.236			-4.236
4	94.3	76.187	67.7	55.366	5.994	3.203			-2.819
5	85.2	67.374	59.4	50.418	2.819	1.745			-1.745
6									3.203
7									5.035
8									5.507
9									5.994
10									13.793

Data entry verified against EXCEL spreadsheet.  
 Normalized combined percent mortality and abnormality (NCMA) was significantly greater in test sediment SD-101 than in reference sediment REF-EBB at  $\alpha=0.10$ .

*MR 6-5-06*

Project Name: P738-3 Mytilus larval NCMA

Sample: x1  
 Samp ID: SD-102  
 Alias: NAS #0423G  
 Replicates: 5  
 Mean: 56.36  
 SD: 27.969  
 Tr Mean: 48.84  
 Trans SD: 17.562

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 61.78  
 SD: 14.952  
 Tr Mean: 52.163  
 Trans SD: 9.257

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 9.109 SS: 1576.539 K: 5 b: 38.335  Alpha Level: 0.05 Calculated Value: 0.9321 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 12.905 Test Residual SD: 10.013 Ref. Residual Mean: 6.798 Ref. Residual SD: 5.285 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 1.2061 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: ArcSin  Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$  Degrees of Freedom: 8 Experimental Alpha Level: 0.1 Calculated Value: -0.3743 Critical Value: $\geq 1.397$ Accept Null Hypothesis: Yes  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	82.5	65.271	43.3	41.15	16.43	11.014			-26.134
2	47.2	43.395	83.4	65.956	5.446	13.793			-11.014
3	81.7	64.673	55.1	47.927	15.832	4.236			-5.446
4	14.9	22.706	67.7	55.366	26.134	3.203			-4.236
5	55.5	48.158	59.4	50.418	0.683	1.745			-1.745
6									-0.683
7									3.203
8									13.793
9									15.832
10									16.43

Data entry verified against EXCEL spreadsheet.

Normalized combined percent mortality and abnormality (NCMA) was not significantly greater in test sediment SD-102 than in reference sediment REF-EBB at  $\alpha=0.10$ .

*msk 6-5-06*

Project Name: P738-3 Mytilus larval NCMA

Sample: x1  
 Samp ID: SD-103  
 Alias: NAS #0424G  
 Replicates: 5  
 Mean: 79.14  
 SD: 9.131  
 Tr Mean: 63.265  
 Trans SD: 6.569

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 61.78  
 SD: 14.952  
 Tr Mean: 52.163  
 Trans SD: 9.257

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 5.208 SS: 515.432 K: 5 b: 22.486  Alpha Level: 0.05 Calculated Value: 0.9809 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 5.219 Test Residual SD: 3.018 Ref. Residual Mean: 6.798 Ref. Residual SD: 5.285 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 0.5801 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: ArcSin  Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$  Degrees of Freedom: 8 Experimental Alpha Level: <u>0.1</u> Calculated Value: 2.1868 Critical Value: $\geq 1.397$ <u>Accept Null Hypothesis: No</u>  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	67.7	55.366	43.3	41.15	7.899	11.014			-11.014
2	84.7	66.974	83.4	65.956	3.709	13.793			-7.899
3	81.2	64.304	55.1	47.927	1.039	4.236			-5.149
4	90	71.565	67.7	55.366	8.3	3.203			-4.236
5	72.1	58.116	59.4	50.418	5.149	1.745			-1.745
6									1.039
7									3.203
8									3.709
9									8.3
10									13.793

Data entry verified against EXCEL spreadsheet.  
 Normalized combined percent mortality and abnormality (NCMA) was significantly greater in test sediment SD-103 than in reference sediment REF-EBB at  $\alpha=0.10$ .

*mk 6-5-06*

Project Name: P738-3 Mytilus larval NCMA

Sample: x1  
 Samp ID: SD-104  
 Alias: NAS #0425G  
 Replicates: 5  
 Mean: 77.02  
 SD: 8.537  
 Tr Mean: 61.673  
 Trans SD: 5.906

Ref Samp: x2  
 Ref ID: REF-EBB  
 Alias: NAS #0426G  
 Replicates: 5  
 Mean: 61.78  
 SD: 14.952  
 Tr Mean: 52.163  
 Trans SD: 9.257

Shapiro-Wilk Results:	Levene's Results:	Test Results:
Residual Mean: 0 Residual SD: 5.038 SS: 482.341 K: 5 b: 21.767  Alpha Level: 0.05 Calculated Value: 0.9823 Critical Value: $\leq 0.842$  Normally Distributed: Yes  Override Option: N/A	Test Residual Mean: 4.57 Test Residual SD: 2.962 Ref. Residual Mean: 6.798 Ref. Residual SD: 5.285 Deg. of Freedom: 8  Alpha Level: 0.1 Calculated Value: 0.8223 Critical Value: $\geq 1.86$  Variances Homogeneous: Yes	Statistic: Student's t Balanced Design: Yes Transformation: ArcSin  Experimental Hypothesis Null: $x1 \leq x2$ Alternate: $x1 > x2$  Degrees of Freedom: 8 Experimental Alpha Level: <u>0.1</u> Calculated Value: 1.9365 Critical Value: $\geq 1.397$ <u>Accept Null Hypothesis: No</u>  Power: Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	87.3	69.122	43.3	41.15	7.449	11.014			-11.014
2	83	65.65	83.4	65.956	3.977	13.793			-7.644
3	72.9	58.629	55.1	47.927	3.044	4.236			-4.236
4	65.5	54.029	67.7	55.366	7.644	3.203			-3.044
5	76.4	60.935	59.4	50.418	0.738	1.745			-1.745
6									-0.738
7									3.203
8									3.977
9									7.449
10									13.793

Data entry verified against EXCEL spreadsheet.

Normalized combined percent mortality and abnormality (NCMA) was significantly greater in test sediment SD-104 than in reference sediment REF-EBB at  $\alpha=0.10$ .

*mlr*  
6-5-06



Water Quality Data File										
	NAS	CLIENT								
BKR	SMPL	DESCRIP	REP	DAY	TEMP	pH	SAL	DO	S	NH3
6	0425G	SD-104	6	0	15.2	7.7	27.0	7.6	<0.1	0.9
19	0422G	SD-101	6	0	15.3	7.5	27.0	6.4	<0.1	1.0
20	0423G	SD-102	6	0	15.2	7.6	27.0	6.9	<0.1	0.3
21	0427G	REF-YB	6	0	15.2	7.8	27.5	6.6	<0.1	0.8
25	0426G	REF-EBB	6	0	15.2	7.8	27.0	7.3	<0.1	0.8
37	0424G	SD-103	6	0	15.1	7.6	27.0	6.8	<0.1	0.9
41	0421G	SD-100	6	0	15.0	7.5	27.0	6.8	<0.1	0.5
42	swcontrol	swcontrol	6	0	15.2	7.9	27.0	6.8	<0.1	0.2
6	0425G	SD-104	6	1	16.0	7.8	27.5	8.0		
19	0422G	SD-101	6	1	16.0	7.7	27.5	7.8		
20	0423G	SD-102	6	1	16.0	7.7	27.0	8.0		
21	0427G	REF-YB	6	1	16.1	7.8	27.5	8.1		
25	0426G	REF-EBB	6	1	16.1	7.8	27.5	8.0		
37	0424G	SD-103	6	1	15.9	7.7	27.0	7.9		
41	0421G	SD-100	6	1	15.9	7.7	28.0	8.0		
42	swcontrol	swcontrol	6	1	15.8	7.8	28.5	8.1		
6	0425G	SD-104	6	2	15.9	7.8	28.0	8.0	<0.1	0.6
19	0422G	SD-101	6	2	16.1	7.7	27.5	7.8	<0.1	0.7
20	0423G	SD-102	6	2	16.1	7.7	27.5	7.8	<0.1	0.2
21	0427G	REF-YB	6	2	16.0	7.8	28.0	7.9	<0.1	0.6
25	0426G	REF-EBB	6	2	16.0	7.8	27.5	7.9	<0.1	0.6
37	0424G	SD-103	6	2	15.8	7.7	28.0	7.8	<0.1	0.6
41	0421G	SD-100	6	2	15.9	7.7	28.0	7.7	<0.1	0.3
42	swcontrol	swcontrol	6	2	15.8	7.9	28.5	8.0	<0.1	0.1
					Mean	15.7	7.7	27.5	7.6	---
					SD	0.4	0.1	0.5	0.5	---
					n	24	24	24	24	16
					Min	15.0	7.5	27.0	6.4	<0.1
					Max	16.1	7.9	28.5	8.1	<0.1

*Data entry verified against laboratory  
bench sheets*

*mer  
3-27-06*

**CHAIN-OF-CUSTODY RECORDS**

## Sample Chain-of-Custody/Analysis Request

## Possible Hazards

Client: Enviro Logic Resources Report to: Taku Fuji  
 Site: Astoria Area - Wide Company: Kennedy/Jenks  
 Project No.: 0592004.00 Address: 200 SW Market St. #500  
 Sampler Name: Tom Pinit / Cindy Ryals Portland, OR 97201  
 Telephone: 503-295-4911 Fax: 503-295-4901

## (5) Analyses Requested

Lab Destination: Northwestern Aquatic Science  
 Address: 3814 Yaquina Bay Rd.  
Newport, OR 97365  
 Telephone: 541-265-7225  
 Carrier/Way Bill No.:

(1) Lab ID No.	(2) Client ID No.	(3) Collection Date	(4) Type	(5) Depth	(6) Comp. Press.	(7) Temp. around	(8) Comments/Conditions (container type, container number, etc.)
SD-100	112406	1145	S		0421G		5 x 1-L glass
SD-101		1220	S		0422G		Measure interstitial ammonia & sulfide
SD-102		1300	S		0423G		upon receipt
SD-103		1330	S		0424G		
SD-104		1400	S		0425G		Hold until further
REF-EBB		1630	S		0426G		directed (awaiting
REF-YB		1510	S		0427G		chemical analysis)
							Reference
							Reference
							gears were full (no head space)
							cooler temperatures: 1.5°C, 3.0°C, 2.0°C

(4) Preservation of sample.

(5) Write each analysis requested across top. Place an "X" in appropriate column to indicate type of analysis needed for each sample.

(3) Mark each sample which should be composited in Laboratory as follows: Place an "X" in box for each sample that should be composited into one sample; use sequential letter for additional groups.

Sample Relinquished By				Sample Received By			
Print Name	Signature	Company	Date	Print Name	Signature	Company	Date
P. THOMAS PINIT	P. Jedd/Cb	K/J	11/27/06	Michael S. Redmond	M. S. Redmond	NAS	11/27/06 13:45



**REFERENCE TOXICANT RESULTS AND ANALYSIS**

Test No. 999-2078

Client:

QC Test

Investigator

REVIEWED  
PAGES 1-9  
-651MR  
6-13-06

## STUDY MANAGEMENT

Client: QC Test

Client's Study Monitor: QC Test

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir. G.J. Irissari

QA Officer L.K. Nemeth

1. Susan Gape

2. M.S. Redmond

3. GABRIEL

4.

Study Schedule:

Test Beginning: 2-21-06 1535 hrs

Test Ending: 2-23-06 1500 hrs

## TEST MATERIAL

Description: Copper as CuSO<sub>4</sub>·5H<sub>2</sub>O, Argent Lot# 0195, 1.0 mg/ml stock prepared: 3-24-04

NAS Sample No.

Date of Collection:

Date of Receipt:

Temperature (deg C):

Dissolved oxygen (mg/L):

pH:

Conductivity (umhos/cm):

Hardness (mg/L):

Alkalinity (mg/L):

Salinity (ppt):

Total chlorine (mg/L):

Total ammonia-N (mg/L):

## DILUTION WATER

Description: Yaquina Bay, OR Seawater

Date of Collection: 2-27-06 2-20-06 Salinity (ppt) 30.0 pH 7.9

Treatments: Aerated, filtered to 0.4 um, salinity adjusted with Milli-Q® deionized water

## TEST ORGANISMS

Species: Mytilus galloprovincialis

Date Received: 2-15-06

Source: Carlsbad Aquafarm, Carlsbad, CA

Acclimation Data:

Date	Temp (deg.C)	DO (mg/L)	pH	Sal (ppt)	Comments
2-6-06	9.0	7.8	7.9	26.5	Held outside in trays of flowing seawater
2-10-06	9.3	8.6	8.1	28.5	
2-12-06	11.0	8.3	7.8	31.6	
2-13-06	8.1	11.2	7.8	31.0	
2-17-06	5.1	12.4	8.0	29.5	
2-20-06	4.0	10.0	8.1	33.5	
Mean	7.8 5.7	10.7 11.2	8.0 8.0	30.0 31.3	
S.D.	2.7 2.1	1.6 1.2	0.1 0.2	2.4 2.0	
(N)	6 3	6 3	6 3	6 3	

Photoperiod during acclimation: Outdoor ambient conditions

- Error codes: 1) correction of handwriting error  
 2) written in wrong location; entry deleted  
 3) wrong date deleted, replaced with correct date  
 4) error found in measurement; measurement repeated

## BIVALVE LARVAL TEST BASED ON EPA/600/R-95/136

Test No. 999-2078 Client \_\_\_\_\_ QC Test \_\_\_\_\_ Investigator \_\_\_\_\_

## SPAWNING AND GAMETE HANDLING

Spawning: Initial: 0910 AM/PM Final: 0937 AM/PM Fertilization: 1220 AM/PMNumber of organisms used: females: 9 males: 4

Egg Dilution (1 ml diluted to 100 ml):

Count/ml of dilution: 1. 76 2. 56 3. 41 Mean: 54Dilution factor = DF (mean x 100/2500) = 41

FURTHER DILUTED 1:10 WITH DILUTION WATER

## TEST PROCEDURES AND CONDITIONS

Test concentrations (50% series recommended): 64, 32, 16, 8, 4, 2, 1 and 0 ug/L

Test chamber: 30 ml glass vials

Test volume: 10 ml

Replicates/treatment (4): 4Organisms/ml (15-30): 19.3

Test water changes: None

Aeration during test: None

Feeding: None

Photoperiod: 16L:8D

Salinity: 30 +/- 2 ppt

Temperature: 20 +/- 1 °C, oysters, 16 +/- 1 °C, mussels

Beaker placement: Stratified randomization

## RANDOMIZATION CHART

A	<del>0</del>	32	2	16	8	64	4	1		
B	4	8	2	64	<del>0</del>	1	32	16		
C	64	16	4	2	32	8	1	<del>0</del>		
D	32	64	<del>0</del>	2	8	16	4	1		

## PREPARATION OF TEST SOLUTIONS

This test uses a brine control \_\_\_\_\_; a salinity control \_\_\_\_\_

If a brine control is used, follow SOP #6208 to prepare test solutions

Date of brine preparation: \_\_\_\_\_; brine salinity (ppt) \_\_\_\_\_

Source of seawater: Yaquina Bay, Oregon

$$VB = VE \frac{(TS - SE)}{(SB - TS)} = VE \frac{(-)}{(-)} = VE (-)$$

Where:

VB=volume brine

VE=volume effluent

SB=salinity of brine

SE=salinity of effluent

TS=target salinity

In making up either a brine control or a salinity control, use salinity-adjusted deionized water in place of the effluent.

2-21-06  
632

Test Conc. (Cu, ug/L)	ml of working stock #2 (2 ug/mL)	Dilution water (ml/100mL)
64	3.2	Brought up to a
32	1.6	final volume of
16	0.8	100 ml with
8	0.4	dilution water.
4	0.2	
2	0.1	
1	0.05	
0	0	

1st working stock made by 1:99 (1.0 mL  $\uparrow$  100mL) dilution of concentrated 1 mg/mL stock solution. Final concentration 10 ug/mL.

2nd working stock made (working stock #2) made by 20:80 (20 mL  $\uparrow$  100mL) dilution of 1st working stock. Final concentration 2 ug/mL.

Test No. 999-2078 Client \_\_\_\_\_ QC Test \_\_\_\_\_ Investigator \_\_\_\_\_

## WATER QUALITY DATA

Date: 2-21-06 initials: af/UBDate: 2-23-06 initials: af

Conc. (ug/L)	Temp. (deg.C)	DO (mg/L)	Sal. (ppt)	pH	Temp. (deg.C)	DO (mg/L)	Sal. (ppt)	pH
64	<u>15.2</u>	<u>8.0</u>	<u>29.5</u>	<u>7.9</u>	<u>15.6</u>	<u>7.9</u>	<u>29.5</u>	<u>8.0</u>
32	<u>15.3</u>	<u>8.0</u>	<u>29.5</u>	<u>7.9</u>	<u>15.6</u>	<u>7.9</u>	<u>29.5</u>	<u>8.0</u>
16	<u>15.3</u>	<u>8.0</u>	<u>30.0</u>	<u>7.9</u>	<u>15.6</u>	<u>7.9</u>	<u>30.0</u>	<u>8.0</u>
8	<u>15.3</u>	<u>8.0</u>	<u>30.0</u>	<u>7.9</u>	<u>15.6</u>	<u>7.9</u>	<u>30.0</u>	<u>8.0</u>
4	<u>15.2</u>	<u>8.1</u>	<u>30.0</u>	<u>7.9</u>	<u>15.6</u>	<u>7.9</u>	<u>30.0</u>	<u>8.0</u>
2	<u>15.3</u>	<u>8.0</u>	<u>30.0</u>	<u>7.9</u>	<u>15.6</u>	<u>7.9</u>	<u>30.0</u>	<u>8.0</u>
1	<u>15.3</u>	<u>8.0</u>	<u>30.0</u>	<u>7.9</u>	<u>15.5</u>	<u>7.9</u>	<u>30.5</u>	<u>8.0</u>
Control	<u>15.3</u>	<u>8.0</u>	<u>30.0</u>	<u>7.9</u>	<u>15.6</u>	<u>7.9</u>	<u>30.0</u>	<u>8.0</u>
Brine control	---	---	---	---	---	---	---	---

## WATER QUALITY:

Temperature (°C):

DO (mg/L):

Salinity (ppt):

pH:

Mean

SD

N

<u>15.4</u>	<u>0.2</u>	<u>16</u>
<u>8.0</u>	<u>0.1</u>	<u>16</u>
<u>29.9</u>	<u>0.3</u>	<u>16</u>
<u>8.0</u>	<u>0.1</u>	<u>16</u>

## WATER BATH TEMPERATURE (°C):

Day 0: 15.3Day 0: 15.5Day 1: 16.0Day 1: 15.9Day 2: 15.6Day 2: 15.7

## LARVAL COUNT DATA

Conc. (ug/L)	Replicate 1		Replicate 2		Replicate 3		Replicate 4	
	N	A	N	A	N	A	N	A
64	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
32	<u>0</u>	<u>41</u>	<u>0</u>	<u>31</u>	<u>0</u>	<u>45</u>	<u>0</u>	<u>27</u>
16	<u>0</u>	<u>182</u>	<u>0</u>	<u>175</u>	<u>0</u>	<u>183</u>	<u>0</u>	<u>174</u>
8	<u>122</u>	<u>70</u>	<u>139</u>	<u>72</u>	<u>114</u>	<u>87</u>	<u>127</u>	<u>78</u>
4	<u>184</u>	<u>12</u>	<u>169</u>	<u>9</u>	<u>182</u>	<u>12</u>	<u>168</u>	<u>10</u>
2	<u>183</u>	<u>10</u>	<u>168</u>	<u>13</u>	<u>182</u>	<u>8</u>	<u>188</u>	<u>12</u>
1	<u>178</u>	<u>7</u>	<u>183</u>	<u>9</u>	<u>186</u>	<u>13</u>	<u>177</u>	<u>9</u>
Control	<u>177</u>	<u>12</u>	<u>191</u>	<u>10</u>	<u>176</u>	<u>13</u>	<u>178</u>	<u>10</u>
Brine control	---	---	---	---	---	---	---	---
Zero time	<u>185</u>	<u>198</u>	<u>189</u>	<u>188</u>	<u>188</u>	<u>209</u>		

Zero time: Mean 193 SD 9 N 6CV=(sd/mean)x100 4.7%

Remarks:

# Carlsbad Aquafarms, LLC

# Invoice

Mail: P.O. Box 2600 92018  
4600 Carlsbad Blvd.  
Carlsbad, CA 92008  
760 438 2444

DATE	INVOIC...
2/13/2006	7627

**BILL TO:**

Northwestern Aquatic Sciences  
P.O. Box 1437  
Newport, Oregon 97365  
Phone 541-265-7225  
Fax 541-265-2799

**SHIP TO:**

Northwestern Aquatic Sciences  
3814 Yaquina Bay Road  
Newport, Oregon 97365  
FedX 097240973  
UPS 849169

P.O. #	TERMS	SHIP DA...	SHIP VIA	F.O.B.	AIRBILL #
	Net 30	2/14/2006	FEDX	S.D.	854303881255
QUANTI...	ITEM	DESCRIPTION		PRICE LBS.	AMOUNT
1	Bio Assay Mus	Mytilus Gallo Provincialis		125.00	125.00
1	BOX CHARGE			10.00	10.00
Received by WTM 2-15-06					

THIS IS YOUR INVOICE

Total \$135.00

# Bivalve Larval Survival and Development Test - Proportion Alive

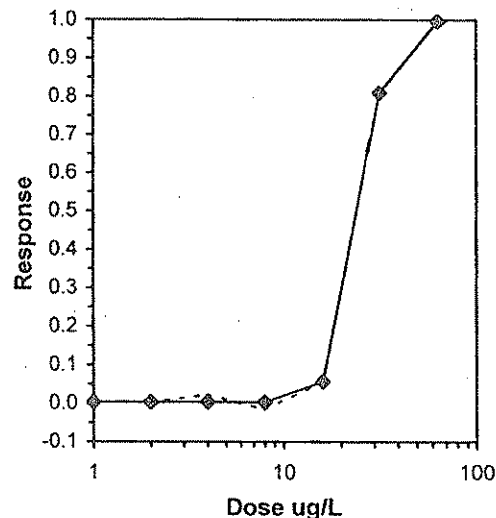
Start Date: 2/21/06 15:35 Test ID: 999-2078 Sample ID: REF-Ref Toxicant  
 End Date: 2/23/06 15:00 Lab ID: ORNAS-Northwestern Aquati Sample Type: CUSO-Copper sulfate  
 Sample Date: Protocol: EPAW 95-EPA West Coast Test Species: MG-Mytilus galloprovincialis  
 Comments:

Conc-ug/L	1	2	3	4
D-Control	0.9793	1.0000	0.9793	0.9741
1	0.9585	0.9948	1.0000	0.9637
2	1.0000	0.9378	0.9845	1.0000
4	1.0000	0.9223	1.0000	0.9223
8	0.9948	1.0000	1.0000	1.0000
16	0.9430	0.9067	0.9585	0.9016
32	0.2124	0.1606	0.2332	0.1399
64	0.0052	0.0000	0.0000	0.0052

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Number Resp	Total Number
			Mean	Min	Max	CV%	N					
D-Control	0.9832	1.0000	1.4491	1.4091	1.5348	3.980	4				13	772
1	0.9793	0.9960	1.4446	1.3658	1.5348	5.869	4	0.082	2.480	0.1361	16	772
2	0.9806	0.9974	1.4585	1.3188	1.5348	7.006	4	-0.171	2.480	0.1361	15	772
4	0.9611	0.9776	1.4115	1.2883	1.5348	10.084	4	0.686	2.480	0.1361	30	772
8	0.9987	1.0158	1.5258	1.4988	1.5348	1.181	4	-1.397	2.480	0.1361	1	772
*16	0.9275	0.9433	1.3019	1.2516	1.3658	4.230	4	2.684	2.480	0.1361	56	772
*32	0.1865	0.1897	0.4447	0.3833	0.5039	12.652	4	18.307	2.480	0.1361	628	772
*64	0.0026	0.0026	0.0540	0.0360	0.0720	38.523	4	25.427	2.480	0.1361	770	772

Auxiliary Tests						Statistic		Critical		Skew	Kurt				
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)						0.97267		0.904		-0.1225	-0.3988				
Bartlett's Test indicates equal variances (p = 0.04)						14.7559		18.4753							
Hypothesis Test (1-tail, 0.05)						NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test						8	16	11.3137		0.05024	0.05099	1.25791	0.00602	6.4E-20	7, 24

Trimmed Spearman-Kärber			
Trim Level	EC50	95% CL	
0.0%			
5.0%	24.786	24.235	25.349
10.0%	24.395	23.861	24.941
20.0%	24.055	23.661	24.456
Auto-0.3%	24.823	24.260	25.399



# Bivalve Larval Survival and Development Test Proportion Normal

Start Date: 2/21/06 15:35 Test ID: 999-2078 Sample ID: REF-Ref Toxicant  
 End Date: 2/23/06 15:00 Lab ID: ORNAS-Northwestern Aquati Sample Type: CUSO-Copper sulfate  
 Sample Date: Protocol: EPAW 95-EPA West Coast Test Species: MG-Mytilus galloprovincialis  
 Comments:

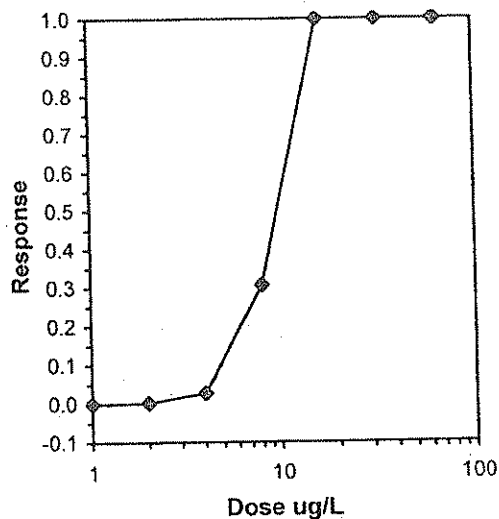
Conc-ug/L	1	2	3	4
D-Control	0.9171	0.9896	0.9119	0.9223
1	0.9223	0.9482	0.9637	0.9171
2	0.9482	0.8705	0.9430	0.9741
4	0.9534	0.8756	0.9430	0.8705
8	0.6321	0.7202	0.5907	0.6580
16	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Number Resp	Total Number
			Mean	Min	Max	CV%						
D-Control	0.9352	1.0000	1.3263	1.2695	1.4688	7.186	4				50	772
1	0.9378	1.0028	1.3218	1.2787	1.3792	3.561	4	0.085	2.360	0.1253	48	772
2	0.9339	0.9986	1.3207	1.2026	1.4091	6.523	4	0.107	2.360	0.1253	51	772
4	0.9106	0.9737	1.2740	1.2026	1.3531	6.165	4	0.986	2.360	0.1253	69	772
*8	0.6503	0.6953	0.9388	0.8766	1.0134	6.114	4	7.299	2.360	0.1253	270	772
16	0.0000	0.0000	0.0360	0.0360	0.0360	0.000	4				772	772
32	0.0000	0.0000	0.0360	0.0360	0.0360	0.000	4				772	772
64	0.0000	0.0000	0.0360	0.0360	0.0360	0.000	4				772	772

Auxiliary Tests					Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.96432	0.868	0.37393	-0.4801		
Bartlett's Test indicates equal variances (p = 0.80)					1.66366	13.2767				
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	4	8	5.65685		0.07202	0.0765	0.11245	0.00564	7.2E-06	4, 15

## Trimmed Spearman-Kärber

Trim Level	EC50	95% CL	
0.0%	8.9625	8.7452	9.1851
5.0%	9.1995	8.9648	9.4404
10.0%	9.3364	9.0646	9.6163
20.0%	9.5786	9.1654	10.0104
Auto-0.0%	8.9625	8.7452	9.1851



# Bivalve Larval Survival and Development Test Proportion Normal

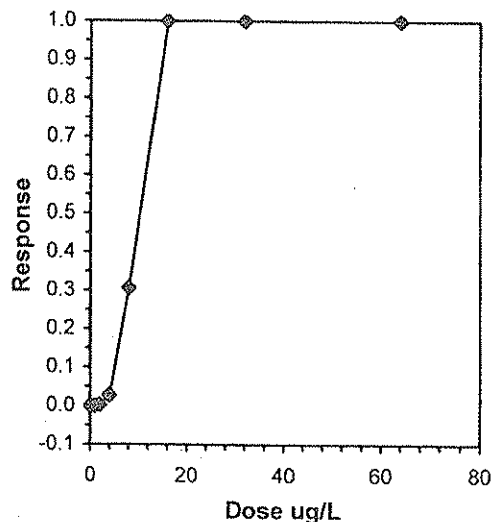
Start Date: 2/21/06 15:35 Test ID: 999-2078 Sample ID: REF-Ref Toxicant  
 End Date: 2/23/06 15:00 Lab ID: ORNAS-Northwestern Aquati Sample Type: CUSO-Copper sulfate  
 Sample Date: Protocol: EPAW 95-EPA West Coast Test Species: MG-Mytilus galloprovincialis  
 Comments:

Conc-ug/L	1	2	3	4
D-Control	0.9171	0.9896	0.9119	0.9223
1	0.9223	0.9482	0.9637	0.9171
2	0.9482	0.8705	0.9430	0.9741
4	0.9534	0.8756	0.9430	0.8705
8	0.6321	0.7202	0.5907	0.6580
16	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000

Conc-ug/L	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	N				Mean	N-Mean
D-Control	0.9352	1.0000	1.3263	1.2695	1.4688	7.186	4				0.9365	1.0000
1	0.9378	1.0028	1.3218	1.2787	1.3792	3.561	4	0.085	2.360	0.1253	0.9365	1.0000
2	0.9339	0.9986	1.3207	1.2026	1.4091	6.523	4	0.107	2.360	0.1253	0.9339	0.9972
4	0.9106	0.9737	1.2740	1.2026	1.3531	6.165	4	0.986	2.360	0.1253	0.9106	0.9723
*8	0.6503	0.6953	0.9388	0.8766	1.0134	6.114	4	7.299	2.360	0.1253	0.6503	0.6943
16	0.0000	0.0000	0.0360	0.0360	0.0360	0.000	4				0.0000	0.0000
32	0.0000	0.0000	0.0360	0.0360	0.0360	0.000	4				0.0000	0.0000
64	0.0000	0.0000	0.0360	0.0360	0.0360	0.000	4				0.0000	0.0000

Auxiliary Tests					Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.96432	0.868	0.37393	-0.4801
Bartlett's Test indicates equal variances (p = 0.80)					1.66366	13.2767		
Hypothesis Test (1-tail, 0.05)					NOEC	LOEC	ChV	TU
Dunnett's Test					4	8	5.65685	0.07202
					MSDu	MSDp	MSB	MSE
					0.0765	0.11245	0.00564	7.2E-06
					F-Prob	df		
					4, 15			

Linear Interpolation (200 Resamples)					
Point	ug/L	SD	95% CL(Exp)	Skew	
IC05	4.321	0.673	0.575	4.904	-1.9841
IC10	5.041	0.294	3.758	5.664	-0.7162
IC15	5.760	0.272	4.647	6.468	-0.3794
IC20	6.480	0.286	5.577	7.405	0.0091
IC25	7.199	0.329	6.322	8.305	0.2521
IC40	9.087	0.264	8.213	9.817	-0.1884
IC50	10.239	0.220	9.511	10.847	-0.1884



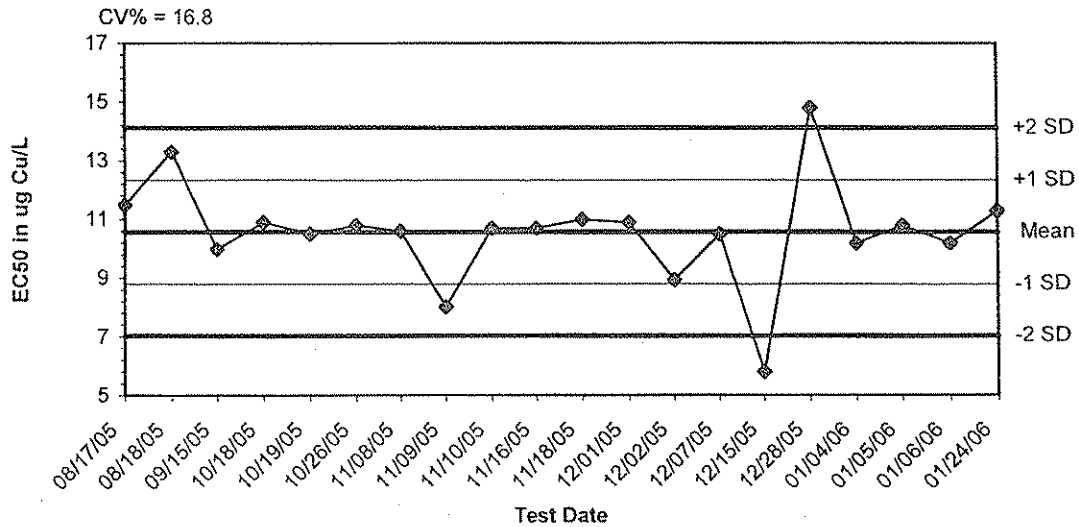


Test: BV-Bivalve Larval Survival and Development Test      Test ID: 999-2078  
 Species: MG-Mytilus galloprovincialis      Protocol: EPAW 95-EPA West Coast  
 Sample ID: REF-Ref Toxicant      Sample Type: CUSO-Copper sulfate  
 Start Date: 2/21/06 15:35      End Date: 2/23/06 15:00      Lab ID: ORNAS-Northwestern Aquatic Sciences

Pos	ID	Rep	Group	Initial Density	Final Density	Total Counted	Number Normal	Notes
	1	1	D-Control	193	189	193	177	
	2	2	D-Control	193	201	193	191	
	3	3	D-Control	193	189	193	176	
	4	4	D-Control	193	188	193	178	
	5	1	1.000	193	185	193	178	
	6	2	1.000	193	192	193	183	
	7	3	1.000	193	199	193	186	
	8	4	1.000	193	186	193	177	
	9	1	2.000	193	193	193	183	
	10	2	2.000	193	181	193	168	
	11	3	2.000	193	190	193	182	
	12	4	2.000	193	200	193	188	
	13	1	4.000	193	196	193	184	
	14	2	4.000	193	178	193	169	
	15	3	4.000	193	194	193	182	
	16	4	4.000	193	178	193	168	
	17	1	8.000	193	192	193	122	
	18	2	8.000	193	211	193	139	
	19	3	8.000	193	201	193	114	
	20	4	8.000	193	205	193	127	
	21	1	16.000	193	182	193	0	
	22	2	16.000	193	175	193	0	
	23	3	16.000	193	185	193	0	
	24	4	16.000	193	174	193	0	
	25	1	32.000	193	41	193	0	
	26	2	32.000	193	31	193	0	
	27	3	32.000	193	45	193	0	
	28	4	32.000	193	27	193	0	
	29	1	64.000	193	1	193	0	
	30	2	64.000	193	0	193	0	
	31	3	64.000	193	0	193	0	
	32	4	64.000	193	1	193	0	

Comments:

**Mytilus galloprovincialis 48-hr larval reference toxicant test - last 20 points**



Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
08/17/05	11.5000	10.5725	8.7994	7.0263	12.3456	14.1187
08/18/05	13.3000	10.5725	8.7994	7.0263	12.3456	14.1187
09/15/05	9.9800	10.5725	8.7994	7.0263	12.3456	14.1187
10/18/05	10.9000	10.5725	8.7994	7.0263	12.3456	14.1187
10/19/05	10.5000	10.5725	8.7994	7.0263	12.3456	14.1187
10/26/05	10.8000	10.5725	8.7994	7.0263	12.3456	14.1187
11/08/05	10.6000	10.5725	8.7994	7.0263	12.3456	14.1187
11/09/05	8.0200	10.5725	8.7994	7.0263	12.3456	14.1187
11/10/05	10.7000	10.5725	8.7994	7.0263	12.3456	14.1187
11/16/05	10.7000	10.5725	8.7994	7.0263	12.3456	14.1187
11/18/05	11.0000	10.5725	8.7994	7.0263	12.3456	14.1187
12/01/05	10.9000	10.5725	8.7994	7.0263	12.3456	14.1187
12/02/05	8.9400	10.5725	8.7994	7.0263	12.3456	14.1187
12/07/05	10.5000	10.5725	8.7994	7.0263	12.3456	14.1187
12/15/05	5.8100	10.5725	8.7994	7.0263	12.3456	14.1187
12/28/05	14.8000	10.5725	8.7994	7.0263	12.3456	14.1187
01/04/06	10.2000	10.5725	8.7994	7.0263	12.3456	14.1187
01/05/06	10.8000	10.5725	8.7994	7.0263	12.3456	14.1187
01/06/06	10.2000	10.5725	8.7994	7.0263	12.3456	14.1187
01/24/06	11.3000	10.5725	8.7994	7.0263	12.3456	14.1187

*mir*  
3-15-06

## Appendix E

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### Chemical Data Quality Review

## Appendix E: Chemical Data Quality Review

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### E.1 Data Quality Assurance Review

A total of seven sediment samples and five surface water samples were collected on 26 January 2006. No field duplicate or field blank samples were collected. Sediment samples were submitted to Columbia Analytical Services (CAS) for analysis of the following:

- Ammonia as Nitrogen (EPA Method 350.3M)
- Total Organic Carbon (PSEP)
- Total Solids (EPA Method 160.3M)
- Total Volatile Solids (PSEP)
- Total Sulfide (PSEP)
- Grain Size (PSEP)
- Total Metals (As, Cd, Cr, Cu, Pb, Ag, Zn - EPA Method 6020; Hg - EPA Method 7471A)
- Polychlorinated Biphenyls (EPA Method 8082)
- Semivolatile Organics (EPA Method 8270C)
- Porewater Tri-n-butyltin (Krone Method).

Surface water samples were submitted to CAS for analysis of the following:

- PAHs (EPA Method 8270C SIM)
- BTEX (EPA Method 8260B).

The following criteria were evaluated in the data quality review process:

- Holding times
- Method blanks
- Surrogate recoveries
- Laboratory control sample and laboratory control sample duplicate (LCS) recoveries
- Matrix spike and matrix spike duplicate (MS/MSD) recoveries
- Laboratory duplicate/triplicate relative percent difference (RPD).

### E.2 Sediment Analytical Data

**Ammonia.** All required holding times were met. No method blank contamination was detected. MS and LCS recoveries were within laboratory control limits. Laboratory duplicate RPDs were acceptable.

**Total Organic Carbon.** All required holding times were met. No method blank contamination was detected. MS and LCS recoveries were within laboratory control limits. Laboratory duplicate and triplicate RPDs were acceptable.

**Total Solids.** All required holding times were met. Analysis of a method blank was not required per the method. Laboratory duplicate RPDs were acceptable.

**Total Volatile Solids.** All required holding times were met. Analysis of a method blank was not required per the method. Laboratory duplicate and triplicate RPDs were acceptable.

**Total Sulfide.** All required holding times were met. No method blank contamination was detected. MS and LCS recoveries were within laboratory control limits. Laboratory duplicate and triplicate RPDs were acceptable.

**Total Metals.** All required holding times were met. Low-level method blank contamination was detected for chromium and reported as an estimated concentration that was less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL) (B). The method blank concentration for chromium was well below the observed concentrations for all analyzed sediment samples. MS and LCS recoveries were within laboratory control limits. Laboratory duplicate RPDs were acceptable.

**Polychlorinated Biphenyls (PCBs).** All required holding times were met. No method blank contamination was detected. Surrogate, LCS and MS/MSD recoveries were within laboratory control limits. The reporting limit was elevated for several Aroclor PCBs in samples SD-100, SD-101, and SD-102 since the chromatogram indicated the presence of non-target background components. The matrix interference prevented adequate resolution of the target compounds at the reporting limit. The results were flagged (Ui) to indicate the matrix interference (Appendix C). The confirmation comparison criteria of 40% difference for Aroclor 1254 was exceeded in a few samples (SD-100, SD-101, SD-102, SD-103). The lower of the two values was reported because of an apparent interference on the alternate column that produced the higher value.

**Semivolatile Organics.** All required holding times were met. Low-level method blank contamination was detected for bis(2-ethylhexyl)phthalate and reported as an estimated concentration that is less than the MRL but greater than or equal to the MDL (J).

The control criteria for the 2,4,6-tribromophenol surrogate in sample SD-100 were not applicable. The control criteria for the 2-fluorobiphenyl and 2,4,6-tribromophenol surrogates in samples SD-101 and SD-102 were not applicable. The analyses of the samples required a dilution (D), which resulted in a surrogate concentration below the MRL. No further corrective action was appropriate.

The advisory criterion was exceeded for benzoic acid and chrysene in the LCS. Per CAS standard operating procedure (SOP) for this method, these compounds were not included in the subset of analytes used to control the analysis. The recovery information reported for these analytes was for advisory purposes only, i.e. to provide additional detail related to the performance of each individual compound. No further corrective action was required. The RPD for benzoic acid in the LCS was outside control criteria. The analyte in question was not detected in the associated field samples. Data quality was not significantly altered, and no further corrective action was appropriate. LCSD recoveries were with laboratory control limits. MS/MSD recoveries were within laboratory control limits.

Samples SD-100, SD-101, and SD-102 required dilutions due to the presence of elevated levels of target analytes. The reporting limits were adjusted to reflect the dilutions.

**Porewater Tri-n-butyltin.** All samples were reanalyzed past the recommended holding time due to a login error. The original analytical batch included analysis of bulk tri-n-butyltin in sediment but did

not include analysis of tri-n-butyltin in porewater. The porewater analysis was performed as soon as possible after receipt by the laboratory. Low-level method blank contamination was detected for tri-n-butyltin and reported as an estimated concentration that is less than the MRL but greater than or equal to the MDL (J).

The reporting limit was elevated in samples SD-100, SD-101, SD-102, and SD-103. The sample extract was diluted (D) prior to analysis due to relatively high levels of non-target background components. The extract was highly colored and viscous, which indicated the need to perform a dilution prior to injection into the instrument. Cleanup of the extract was performed within the scope of the method, but did not eliminate enough of the background components to prevent dilution.

Insufficient sample volume was received to perform MS/MSD, and LCS/LCSD was analyzed and reported instead. Surrogate recoveries, LCS, and LCSD were within laboratory control limits. Laboratory duplicate RPDs were acceptable.

### E.3 Surface Water Analytical Data

**PAHs.** All required holding times were met. Low-level method blank contamination was detected for benzo(k)fluoranthene and reported as an estimated concentration that was less than the MRL but greater than or equal to the MDL (J). The low-level method blank contamination did not impact the results for the analyzed samples and did not require qualification of the analyses. Insufficient sample volume was received to perform a MS/MSD. A LCS/LCSD was analyzed and reported in lieu of the MS/MSD for the surface water samples. Surrogate, LCS, and LCSD recoveries were within laboratory control limits.

**BTEX.** All required holding times were met. No method blank contamination was detected. Surrogate and MS/MSD recoveries were within laboratory control limits. The advisory criterion was exceeded for ethylbenzene in one LCS. Per CAS SOP for this method, this compound was not included in the subset of analytes used to control the analysis. The recovery information provided for this analyte was for advisory purposes only, i.e. to provide additional detail related to the performance of each individual compound. No further corrective action was required.

### E.4 Data Quality Conclusion

Based on our data QA review, all data are deemed acceptable for their intended use.