APPENDIX H

Appendix H contains the Geosyntec consultants report dated September 10, 2007 presenting the Sub-Slab Soil Gas Intrusion Assessment.

Prepared for:

Astoria Area-Wide PRP Group

SUB-SLAB SOIL GAS INTRUSION ASSESSMENT

PORT OF ASTORIA OFFICE BUILDING
ASTORIA AREA-WIDE PETROLEUM SITE
ASTORIA, OREGON
DEQ ECSI FILE #2277

Prepared by:

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Geosyntec Project Number: HX0186

September 10, 2007

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1. INTRODUCTION

1.1 Terms of Reference

Geosyntec Consultants, Inc. (Geosyntec) has prepared this report on behalf of the Astoria Area-Wide PRP Group to present the results of the Sub-Slab Soil Gas Vapor Intrusion Assessment conducted at the Port of Astoria office building located at the Astoria Area-Wide Petroleum Site in Astoria, Oregon. Following completion of the Phase 1 Remedial Investigation/Feasibility Study (RI/FS) for the site, the vapor intrusion pathway was identified as a potentially complete exposure pathway in site buildings overlying petroleum-impacted soil and groundwater. Soil gas investigations were conducted in October and December 2004 to evaluate the vapor intrusion pathway near the Port of Astoria office building (EnviroLogic Resources & GeoSyntec, 2005a). The Port office building was selected for the vapor intrusion assessment because of the presence of free-phase petroleum hydrocarbon in ground-water monitoring wells near the Port office building. Following review of these data, additional site evaluation was proposed directly beneath the Port office building.

A sub-slab soil gas investigation work plan (EnviroLogic Resources & GeoSyntec, 2005b) was submitted to and approved by the Oregon Department of Environmental Quality (DEQ). This investigation was conducted in July 2005 and September 2006.

1.2 Background

The Astoria Area-Wide site includes facilities and properties located at and near the Port of Astoria, as shown on **Figure 1**. The site is bounded by Portway to the northeast, the Columbia River to the northwest, Hamburg Street (including the former Chevron/McCall bulk plant) to the southwest and Marine Drive to the southeast (**Figure 2**).

This area in and around the Port of Astoria has been used for petroleum storage and distribution since the 1920s. Aboveground storage tanks (ASTs), underground storage tanks (USTs), and pipelines were present on several of the facilities subject to this investigation. Historically, the area was home to at least four bulk petroleum storage facilities and five vehicle fueling or service stations between West Marine Drive and the Columbia River in the Property. Inactive pipelines associated with several of the former bulk fuel storage facilities extend onto Pier 2. A complete site history and a

summary of remedial actions completed at the Astoria Area-Wide site are presented in the RI/FS and IRAM Development Work Plan, Phase 1 (RI/FS Work Plan) (EnviroLogic Resources, 2002).

Based on a review of the boring logs completed as part of the Phase 1 soil characterization activities, most of the Astoria Area-Wide site is underlain by gray and light brown fill sand. Lenses of silt and clay are present in the fill as well as gravel, wood, and other organics. In addition, two native materials were encountered beneath the site: native river deposits and the Astoria Formation. The native materials were encountered at depth, consistent with the conceptual hydrogeologic model presented in the RI/FS Work Plan.

Groundwater is generally encountered between 7 and 11 feet below ground surface (bgs) at the site, except along West Marine Drive. The three sites along West Marine Drive have a ground surface elevation approximately 15 feet above the remainder of the site and the depth to groundwater is generally about 22 feet bgs. The depth to water varies seasonally. The occurrence of free product or light non-aqueous phase liquids (LNAPL) has been documented at several locations within the Astoria Area-Wide site. Boring logs and a summary of physical and engineering parameters of selected soil samples are presented in the technical memorandum Phase 1 Source/Soil Characterization (EnviroLogic Resources, 2003).

Soil gas samples were collected at a depth of 5 feet bgs from four monitoring points near the Port office building in October and December 2004. Petroleum hydrocarbons and methane were detected in soil gas samples collected near the perimeter of the building with higher concentrations of petroleum hydrocarbons detected near the southwest corner of the building. A preliminary evaluation of these results indicate that benzene concentrations measured in two soil gas monitoring points may exceed site-specific soil vapor risk-based concentrations (RBCs) calculated for vapor intrusion to commercial buildings. Based on these findings, the heating, ventilation and air conditioning (HVAC) system in the Port office building was upgraded to maintain a positive pressure inside the building and sub-slab soil gas samples were proposed to be collected.

2. INVESTIGATION SCOPE

The investigation was conducted following review of the results of the soil gas investigation completed in October and December 2004. This earlier investigation evaluated shallow soil gas surrounding the Port of Astoria Office Building. Sub-slab soil gas was sampled and analyzed to provide a more detailed assessment of subsurface vapor intrusion. This approach is preferable over indoor air sampling because background sources of hydrocarbons (outdoor air or indoor sources) will have limited influence on sub-slab vapors.

The Port office building is a two-story structure with a footprint of approximately 8,200 square feet (ft^2). The western 5,500 ft^2 of the building consists of slab-on-grade construction while the eastern portion has a crawl space. The sub-slab sample locations were selected to assess the soil gas concentrations throughout the portion of the building built with a slab foundation. Two of the sub-slab probes were selected to target the southwestern portion of the building where the higher soil gas concentrations were detected in the previous investigation.

The scope of work included the installation, pneumatic testing, and sampling of seven sub-slab probes (SSPs) at the Port office building to assess the risk of subsurface vapor intrusion to indoor air. Additionally, outdoor air samples were collected to provide an indication of background ambient air quality while sub-slab samples were collected. Barometric data were collected inside the building during the investigation.

At the request of DEQ, areas identified as potential collection/accumulation areas for subsurface methane gas around the inside and outside of the Port office building were screened for methane. Nineteen locations around and within the building were identified and screened using a landfill gas detector for methane concentration and percent of lower explosive limit (LEL).

3. METHODS

This section describes the methods used during the investigation.

3.1 Summary of Sub-Slab Probe Installation and Sampling Procedures

SSPs were installed at seven locations throughout the Port office building as shown in **Figure 3**. Three SSPs were installed during the July 2005 event (SSP-01, -03, and -04). An attempt was made to install SSP-02 during this event; however, the thickness of the concrete slab was greater than 15 inches and a SSP could not be installed at this location with the equipment available during the field activities. Equipment to drill through the building slab was brought to the site during the September 2006 sampling event and SSP-02 plus three additional probes (SSP-05, -06, and -07) were installed. The procedure for the installation and collection of sub-slab samples is described in the Geosyntec Suggested Operating Procedure for Sub-Slab Soil Gas Monitoring included as **Appendix A**.

Helium was added to a shroud around the ground surface of each probe prior to sample collection. The concentration of helium in the shroud and collected samples were recorded with a portable meter to assess the extent of any atmospheric air leakage into the sample.

3.2 Development and Field Screening

Sub-slab probes were allowed to equilibrate over night following installation. Prior to sampling, sub-slab probes were purged until a minimum of 5 to 7 liters (L) of soil gas were removed and the field screening results stabilized in at least three successive 1-1.5 L purges. This was done to remove atmospheric air that may have entered the borehole during the drilling and installation procedure and to promote the collection of reproducible samples.

Field screening samples were collected in 3 L Tedlar™ bags using a lung box and screened using a MiniRae 2000 photoionization detector (PID), Landtec Gem 2000 landfill gas meter and Dielectric MGD2002 helium detector (for tracer gas), all calibrated according to manufacturer's instructions.

3.3 Sub-Slab Soil Gas Permeability

The gas permeability of geologic materials surrounding the sub-slab probes (i.e., beneath the concrete slab) was evaluated by measuring the flow rate of sub-slab gas through the probe and the resulting vacuum on the probe. These data were analyzed using the radial vapor flow equation (Johnson et al., 1990) to calculate the soil gas permeability.

3.4 Sample Collection

Samples for laboratory analysis were collected from the sub-slab probes by connecting the final Tedlar™ bag sample to a 1-L Summa canister with a 5-micron inline filter using a secure compression fitting. The contents of the Tedlar™ bag were then transferred into the Summa canister by opening the valves on both the bag and the canister.

An outdoor air sample was also collected approximately 75 ft northwest of the Port office building each day the sub-slab samples were collected to characterize the ambient air. The outdoor air samples were collected in a 6-L Summa canister fitted with a 5-micron particulate filter and flow controller to collect a 6-L sample in eight hours.

The samples were sent to Calscience Environmental Laboratories, Inc. of Garden Grove, California and analyzed for the following constituents:

Compounds	Method
Benzene, toluene, ethylbenzene, xylenes, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene	EPA Method TO-15
TPH-g *	EPA Method TO-3
Oxygen, carbon dioxide, methane, and nitrogen	ASTM-D1946

* Note: Analytical methods to analyze air sample for diesel range TPH are not available.

A residual vacuum was left in all canisters and recorded in the field at the time of sampling and at the laboratory at the time of reception to ensure the integrity of the sample was not compromised during shipping

3.4.1 Quality Assurance/Quality Control

Two field duplicate samples were collected. In July 2005, a duplicate sample was collected from SSP-01, and in September 2006, a duplicate sample was collected from SSP-06. These samples were submitted to the laboratory as blind duplicates. These samples as well as additional laboratory control checks were used to assist in the provision of accurate and precise analytical data. Quality assurance/quality control (QA/QC) procedures were implemented by the incorporation of laboratory blanks and laboratory standards or references.

3.5 Barometric and Differential Pressure Measurements

During the July 2005 sampling event, a digital recording barometer was set inside the Port of Astoria Office Building for the duration of the sample period to monitor local barometric pressure fluctuations. Additionally, a differential micromanometer was set up to monitor the pressure across the foundation. The micromanometer was connected to SSP-03 for over 21 hours after probe installation and connected to SSP-04 for approximately 4 hours.

3.6 Methane Screening

Nineteen locations in and around the Site building (**Figure 3**) were identified as potential collection areas for subsurface methane gas (electrical boxes, well casings, crawlspaces, storm sewers manholes, etc.). The areas were screened for methane concentration and percent LEL using a Landtec Gem 2000 Landfill gas meter by placing the inlet tubing of the meter into the area, while minimizing the disruption of natural conditions (e.g. opening access point as slightly as possible to insert sample tube).

4. RESULTS

4.1 Development and Field Screening

The results of the sub-slab and soil gas development and purging data are summarized in **Table 1**. During purging, field screening measurements of volatile organic compounds (VOCs) were taken using a PID and biodegradation indicators (oxygen, carbon dioxide, and methane) were taken using a landfill gas meter. Carbon dioxide is a product of subsurface aerobic biodegradation of hydrocarbons and an increase in carbon dioxide concentration along with a decrease in oxygen concentration in soil gas indicates that natural degradation of hydrocarbons is occurring in soils beneath the site. Methane may be generated due to anaerobic biodegradation. The landfill gas meter became inoperable midway through the September 2006 sampling event and purge samples were not monitored for biodegradation indicators at all locations. Note that the landfill gas meter does not speciate methane and the reported field screening concentrations for this compound are likely biased high.

PID readings ranged from 0.0 to 3.6 parts per million by volume (ppmv) at SSP-02, -03, -04, -05, and -07. These values are near the lower limit of concentrations that can be reproducibly measured with a PID. At SSP-01 and -06, PID readings ranged from 154 to 317 ppmv.

Carbon dioxide readings ranged from 8.5 (SSP-03) to 15.8 (SSP-4) percent and oxygen readings ranged from 0.4 (SSP-01) to 8.1 (SSP-03) percent. As discussed above, these readings suggest that subsurface biodegradation of petroleum hydrocarbons is occurring. Methane readings collected during development and purging ranged from 0.0 (SSP-04 and SSP-03) to 13.1 percent (SSP-01).

Helium concentrations measured during purging from the sub-slab probes and beneath the shroud are summarized in **Table 1**. These helium measurements are collected as part of the leak test during sampling. Field screening readings in Tedlar™ bags were less than 5 percent of the corresponding concentrations in the shroud, indicating that the samples were greater than 95 percent representative of subsurface gas, with no significant leakage of atmospheric air.

4.2 Sub-Slab Soil Gas Permeability

A summary of the gas permeability calculations and results is included in **Table 2**. Calculated gas permeability values for sub-slab probes (SSP-1 to SSP-7) ranged from $2x10^{-11}$ to $1x10^{-9}$ square meters (m^2). These values correspond to sub-slab soils composed of coarse sands to gravelly sands.

4.3 Laboratory Analytical Results

The results of laboratory analyses from samples collected from the sub-slab probes and the outdoor air sample for petroleum volatile organic compounds and for biodegradation parameters are summarized in **Tables 3 and 4,** respectively. Laboratory reports of analysis are provided in **Appendix B**.

Elevated concentrations of petroleum hydrocarbons were detected in SSP-01 and SSP-06. These probes are located in the southwestern portion of the building. Maximum concentrations for Total Petroleum Hydrocarbons as gasoline (TPH-G; 1,900 ppmv[1]), toluene (3,200 microgram per cubic meter [$\mu g/m^3$]), and xylenes (4,500 $\mu g/m^3$) were detected in SSP-01 and maximum concentrations for benzene (7,400 $\mu g/m^3$) and 1,2,4-trimethylbenzene (1,500 $\mu g/m^3$) were detected in SSP-06. Low concentrations of petroleum hydrocarbons (i.e., TPH-g <20 ppmv and individual constituents < 100 $\mu g/m^3$) were detected in the other SSPs sampled during this investigation. In the ambient air samples, petroleum hydrocarbons were not detected above the reporting limit.

Results of the field duplicate analyses indicate reasonable reproducibility for the results. The relative percent differences for the constituents detected in the field duplicate samples were less than 50 percent. Samples were collected during both sampling events at three locations. Concentrations during both events were generally consistent, although the reported concentrations during the September 2006 event were slightly lower than those for the July 2005 event.

[1] The laboratory reports TPH-g concentrations in ppmv. Assuming an average molecular weight of 100 g/mol, the maximum TPH-G concentration is 7,800 mg/m^3.

Concentrations of biodegradation indicators are presented in **Table 4**. Oxygen concentrations in sub-slab samples ranged from 1.4 percent (SSP-01) to 13.7 percent (SSP-05) and carbon dioxide concentrations ranged from 3.5 (SSP-05) to 16.7 percent (SSP-04).

Methane was detected in samples collected from SSP-01 and SSP-06 at concentrations of 1.7 and 1.42 percent, respectively. Note that the methane concentrations reported by the laboratory were lower than those reported by the field instrument. The field instrument detects non-methane hydrocarbons to some degree, so the laboratory measurements for methane are believed to be more representative of site concentrations. The elevated methane concentrations in SSP-01 and SSP-06 reported by the analytical laboratory are approximately 30 – 35 percent of the LEL[2]. However, these samples were collected beneath the foundation where no ignition source is present and field screening (discussed in Section 4.5) did not indicate accumulation of methane within the building.

A Level II data validation was performed on Calscience Work Order No.: 05-07-1353 for EPA TO-15, EPA TO-3 and ASTM D-1946 analytical methods. Compliant to the QAPP, the data deliverable included: a case narrative, sample analytical results, laboratory duplicate and blank results, sample custody and where applicable laboratory control samples. Examination of the Chain-of-Custody and the analytical results forms indicated that all of the technical holding times were met. Laboratory quality assurance samples including method blanks, laboratory duplicates, and laboratory control samples and laboratory control duplicates, were all within method specified acceptance criteria. No validation qualifiers were applied to the data and the results are suitable for use as reported.

4.4 Barometric and Differential Pressure Measurement Results

Results for the barometric pressure and differential pressure measurements taken during the July 2005 sampling and differential pressure measurements collected in February 2006[3] are provided in **Appendix C**. A slight increase in barometric pressure was

[2] The LEL for methane is approximately 5 percent.

[3] February 2006 differential pressure measurements were collected by EnviroLogic Resources, Inc.

measured during the morning of July 22, 2005. The weather at the site was clear on July 21, 2005. Light rain fell during the early morning of July 22, 2005 and the weather was overcast to partly cloudy after approximately 8:00 am.

During the July 2005 monitoring event, the cross-slab pressure difference measured at SSP-03 was negligible; typically ranging from -0.01 to +0.01 in H_2O (-2.5 to +2.5 Pa) and the cross-slab pressure differential measured at SSP-04 was slightly negative (indoor air pressure less than sub-slab pressure) with the greatest pressure differential equal to -0.032 in H_2O (-8 Pa).

During the February 2006 monitoring, a special effort was made to limit the time that perimeter doors and windows were left open. The cross-slab pressure difference measured during this event was slightly positive (approximately 0.0025 in H_2O or 0.6 Pa) while the HVAC system was operating.

4.5 Methane Screening Results

Results for methane screening are provided in **Table 5**. Methane was detected in four locations: the well boxes for MW-3 and MW-9 on the north side of the building and a valve box and electrical access box on the southern side of the building. Note that the methane concentration in the electrical access box was just above the method detection limit. Methane was not detected in any of the potential accumulation points identified inside the building.

5. DATA EVALUATION

5.1 Risk Based Concentrations

Sub-slab soil gas RBCs for vapor migration to indoor air have been calculated to evaluate the data collected during this investigation. The approach used in the development of the sub-slab soil gas RBCs is consistent with DEQ and United States Environmental Protection Agency (USEPA) guidance.

The RBCs for the soil and groundwater to indoor air pathways calculated by DEQ are calculated using the example equations provided in the Standard Guide for Risk-Based Corrective Action at Petroleum Release Sites (ASTM, 1995). These models are based on the Johnson and Ettinger vapor intrusion model (Johnson and Ettinger, 1991), but assume that the convective contribution to the vapor migration is small and can be neglected. More recent guidance on the evaluation of this pathway (USEPA, 2002, 2003) suggests that both the diffusive and convective contributions to vapor transport should be considered. Consequently, the site-specific RBCs will be calculated using the Johnson and Ettinger Model considering both transport mechanisms.

The soil gas RBC is determined by:

$$\mathrm{RBC}_{\text{soil gas}} = RBC_{air} \Big/ \alpha \,. \tag{1}$$

Where $\mathrm{RBC}_{\text{air}}$, the risk based concentration in air, is the value listed in Appendix A of the DEQ risk-based decision making guidance (DEQ, 2003) and α, the vapor intrusion attenuation factor, is defined as the ratio of the indoor air and soil gas concentrations.

The attenuation factor is calculated using the Johnson Ettinger Model:

$$\alpha = \frac{\dfrac{D_T^{eff} A_B}{Q_B L_{cb}} \times Exp\left(\dfrac{Q_{soil} L_{crk}}{D_{crk}^{eff} A_{crk}}\right)}{Exp\left(\dfrac{Q_{soil} L_{crk}}{D_{crk}^{eff} A_{crk}}\right) + \dfrac{D_T^{eff} A_B}{Q_B L_{cb}} + \dfrac{D_T^{eff} A_B}{Q_{soil} L_{cb}}\left(Exp\left(\dfrac{Q_{soil} L_{crk}}{D_{crk}^{eff} A_{crk}}\right) - 1\right)} \tag{2}$$

Where:

D_t^{eff} = Soil effective diffusion coefficient (cm^2/s)
A_B = Area of building (cm^2)
Q_B = Building ventilation rate (cm^3/s)
L_{cb} = Depth of soil gas sample below slab (cm)
Q_{soil} = Soil gas volumetric flow rate (cm^3/s)
L_{crk} = Foundation thickness (cm)
D_{crk}^{eff} = Effective diffusion coefficient through foundation crack (cm^2/s)
A_{crk} = Area of foundation cracks (cm^2)

The effective diffusion coefficient is calculated using:

$$D_t^{eff} = \frac{D_{air}\, n_{air}^{10/3}\, H + D_w\, n_w^{10/3}}{H\, n^2} \quad (3)$$

Where

D_{air} = Diffusion coefficient in air (cm^2/s)
D_w = Diffusion coefficient in water (cm^2/s)
n_{air} = Soil air-filled porosity (cm^3/cm^3)
n_w = Soil water-filled porosity (cm^3/cm^3)
n = Soil porosity (cm^3/cm^3)
H = Henry's law coefficient (cm^3/cm^3)

and the building volumetric flow rate is calculated by:

$$Q_B = \frac{A_B\, L_B\, ER}{86{,}400\ s/day} \quad (4)$$

Where:

A_B = Area of building (cm^2)
L_B = Height of rooms in building (cm)
ER = Building air exchange rate (day^{-1})

All parameters in Equations 2-4 are defined in the Oregon DEQ guidance, except for the volumetric flow rate of soil gas to indoor air, Qsoil. While this parameter may be calculated from site-specific parameters (e.g., soil permeability, building pressure,

depth of cracks, length of cracks), recent research and guidance suggests typical values for this parameter are in the range of 1 to 10 L/min per 100 m^2 of building footprint (Johnson et. al, 1999; USEPA, 2002; and Johnson, 2005). For the Astoria Area-Wide Petroleum Site evaluation, a value of 5 L/min per 100 m^2 building footprint is used for Qsoil. Using Equation 4 above, the building volume flow rate, Q_B, was calculated to be 780,000 cm^3/s (47,000 L/min).

Note that in the limit as Qsoil approaches zero, Equation 2 reduces to Equation B-129 of the Oregon DEQ risk-based decision making guidance (ODEQ, 2003). Also, in the limit as L_{cb} approaches zero (as is the case for sub-slab samples), Equation 2 reduces to:

$$\alpha = \frac{Q_{soil}}{Q_B} \tag{5}$$

The parameters used in the soil gas RBC calculations are summarized in **Table 6**. Oregon DEQ default parameters are primarily used in the RBC calculations; however, site-specific data for L_{cb} and A_B are included in the vapor intrusion calculations. The calculated sub-slab soil gas RBCs are summarized in **Table 7**.

5.2 Area-Weighted Average Concentrations

Area-weighted average sub-slab soil gas concentrations were calculated using the Thiessen polygon method. This method is applied by assigning polygons around each sub-slab probe location to identify the area over which the measured concentrations are representative. Based on the area of each polygon and the reported concentrations for each SSP, an area-weighted average for each contaminant was calculated. If multiple samples were collected at a probe, the maximum concentration was used in the calculations. Also, if the measured concentration was below the reporting limit, then one-half of the maximum reporting limit was used. Details of these calculations as well as the calculated area-weighted average sub-slab soil gas concentrations are provided in **Table 8**.

5.3 Comparison of Measured Sub-Slab Soil Gas Concentrations and RBCs

As a screening-level evaluation, the maximum and area-weighted average sub-slab soil gas concentrations for the constituents of concern at the site are compared to the calculated site-specific RBCs (**Table 9**). The maximum measured sub-slab soil gas

concentrations for benzene and TPH-g slightly exceed the RBCs. Exceedances of the RBCs were detected only in SSP-01 and SSP-06 which are located in the southwestern portion of the building. However, the area-weighted average sub-slab soil gas concentrations beneath the building are all below their respective RBCs.

6. SUMMARY

The following findings were made as a result of the Port of Astoria Office Building sub-slab soil gas investigation:

- The highest concentrations of petroleum hydrocarbons in sub-slab soil gas were found in the southwestern portion of the building in SSP-01 and SSP-06.
- Elevated concentrations of methane in potential accumulation areas were limited to three locations outside of the perimeter of the building.
- Maximum concentrations for TPH-g and benzene slightly exceeded the site-specific sub-slab soil gas RBCs. However, the area-weighted average concentrations for these constituents are below the RBCs. The sub-slab soil gas concentrations for all other constituents of concern are well below the RBCs.

The results of this investigation do not indicate that sub-slab soil gas concentrations at the Port of Astoria Office building pose an unacceptable human health risk due to chronic exposures.

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TABLES

TABLE 1
SUMMARY OF SUB-SLAB SAMPLING FIELD PARAMETERS
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Subslab Number	Date	Elapsed Time (min)	Purge Rate (L/min)	Bag Volume (L)	Cumulative Volume Purged (L)	Well Head Vacuum (inches H_2O)	Helium Tracer Gas (%)			Parameters							Sample Identifications			
							Shroud		Sample	CO_2 (%)		O_2 (%)		CH_4 (%)		VOCs (ppm_v)	Sample ID	Summa Cannister Number	Initial Vacuum (in Hg)	Final Vacuum (in Hg)
							Minimum	Maximum		Field	Lab	Field	Lab	Field	Lab					
SSP-01	22-Jul-05	5	0.2	1.0	1.0	0.1	80	100	0.00	13.2	14.7	1.1	1.4	13.0	1.7	297	SSP-01	LC012	-30.7	-2.9
		10	0.2	1.0	2.0	0.1	80	100	0.30	13.7		0.4		13.1		290	SSP-0X	LC138	-30.6	-4.8
		15	0.2	1.0	3.0	0.1	80	100	0.17	13.7		0.6		13.0		292				
		30 *	0.2	3.0	6.0	-	70	100	0.13	13.7		0.6		10.0		290				
	19-Sep-06	5	0.2	1.0	1.0	-	60	80	0.70	12.7	13.8	3.7	2.5	2.2	0.32	257	SSP-01-GS	LC1174	-29.4	-2.2
		10	0.2	1.0	2.0	-	60	80	0.06	14.1		2.9		2.8		313				
		15*	0.2	1.0	3.0	-	50	60	0.10	13.9		2.9		2.7		317				
SSP-02	20-Sep-06	5	0.2	1.0	1.0	-	60	80	0.24	-	7.7	-	5.4	-	<0.15	0.0	SSP-02-GS	LC1031	-29.9	-3.4
		10	0.2	1.0	2.0	-	60	80	0.72	-		-		-		0.0				
		14*	0.2	0.8	2.8	-	50	60	0.65	-		-		-		0.0				
SSP-03	22-Jul-05	5	0.3	1.5	1.5	0.9	80	100	0.00	8.5	9.6	8.1	8.0	0.0	<0.2	0.8	SSP-03	1062 (LC078)	-30.3	-2.8
		10	0.3	1.5	3.0	0.9	80	100	1.50	8.7		7.4		0.0		3.3				
		15	0.2	1.0	4.0	0.6	70	100	3.40	8.5		7.2		0.0		3.5				
		25 *	0.3	2.5	6.5	-	60	100	4.90	8.6		7.1		0.0		3.4				
	20-Sep-06	5	0.2	1.0	1.0	-	50	70	0.40	-	7.8	-	10.9	-	<0.14	3.6	SSP-03-GS	LC1136	-29.6	-2.4
		10	0.2	1.0	2.0	-	40	60	0.90	-		-		-		3.2				
		14*	0.2	0.8	2.8	-	40	60	1.10	-		-		-		0.9				
SSP-04	22-Jul-05	5	0.3	1.5	1.5	1.6	80	90	0.00	15.6	16.7	1.4	2.1	0.0	<0.2	0.4	SSP-04	LC043	-30.4	-4.7
		10	0.3	1.5	3.0	1.3	80	90	0.00	15.8		1.1		0.0		1.1				
		15	0.2	1.0	4.0	0.9	80	90	0.00	15.7		1.3		0.0		0.6				
		25 *	0.2	2.0	6.0	-	70	90	0.0	15.6		1.2		0.0		1.0				
	20-Sep-06	5	0.2	1.0	1.0	-	40	50	0.80	-	10.0	-	9.6	-	<0.15	0.0	SSP-04-GS	LC1161	-29.9	-3.3
		10	0.2	1.0	2.0	-	30	40	0.90	-		-		-		0.0				
		14*	0.2	0.8	2.8	-	30	40	1.00	-		-		-		0.0				
SSP-05	20-Sep-06	5	0.2	1.0	1.0	-	60	80	0.30	-	3.5	-	13.7	-	<0.15	0.0	SSP-05-GS	LC1163	-29.9	-3.3
		10	0.2	1.0	2.0	-	60	80	0.70	-		-		-		0.0				
		14*	0.2	0.8	2.8	-	40	60	0.60	-		-		-		0.0				
SSP-06	20-Sep-06	5	0.2	1.0	1.0	-	40	60	0.30	-	10.4	-	3.9	-	1.4	154.0	SSP-06-GS	LC1135	-29.5	-1.9
		10	0.2	1.0	2.0	-	40	60	0.80	-		-		-		192.0	SSP-XX-GS	LC1208	-30	-3.8
		14*	0.2	0.8	2.8	-	30	50	0.90	-		-		-		196.0				
SSP-07	20-Sep-06	5	0.2	1.0	1.0	-	60	80	0.21	-	11.7	-	4.1	-	<0.14	0.0	SSP-07-GS	LC1189	-29.9	-0.8
		10	0.2	1.0	2.0	-	60	80	0.65	-		-		-		0.0				
		14*	0.2	0.8	2.8	-	40	50	1.10	-		-		-		0.0				

Notes:

min - minutes
L/min - litres per minute
L - litres
in H2O - inches of water
% - percent
ppmv - parts per million - volume
in Hg - inches of mercury
- - not measured
* - sample collected for laboratory analysis
Landfill gas meter became inoperable during September 2006 sampling. All samples were not field-screened for CO2, O2, and CH4.

TABLE 2
SUMMARY OF SUB-SLAB PNEUMATIC TESTING DATA
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Subslab Probe Number	Date	Barometric Pressure (in Hg)	Elapsed Time (min)	Flow Rate (L/min)	Well Head Vacuum (inches H_2O)	Cumulative Volume (L)	Specific Capacity (L/min/in H_2O)	Range	Gas Permeability (m^2)
SSP-01	22-Jul-05	30.00	1.0	0.2	0.02	0.2	10.0	1.92e-10, 2.34e-10	2×10^{-10}
			2.0	0.5	0.07	0.7	7.1	1.37e-10, 1.67e-10	
			3.0	1.0	0.12	1.7	8.3	1.60e-10, 1.95e-10	
			4.0	5.0	0.90	6.7	5.6	1.07e-10, 1.30e-10	
	19-Sep-06	30.17	1.0	0.2	<0.00	0.2	0.0	nc	1×10^{-9}
			2.0	0.5	0.005	0.7	100.0	1.92e-9, 2.34e-9	
			2.5	1.0	0.04	1.2	25.0	4.80e-10, 5.84e-10	
			2.75	5.0	0.55	2.5	9.1	1.74e-10, 2.12e-10	
SSP-02	20-Sep-06	-	1.0	0.2	0.05	0.2	4.0	7.68e-11, 9.35e-11	8×10^{-11}
			2.0	0.5	0.13	0.7	3.8	7.38e-11, 8.99e-11	
			3.0	1.0	0.25	1.7	4.0	7.68e-11, 9.35e-11	
SSP-03	22-Jul-05	29.97	1.0	0.2	0.17	0.2	1.2	2.26e-11, 2.75e-11	2×10^{-11}
			2.0	0.5	0.40	0.7	1.3	2.40e-11, 2.92e-11	
			3.0	1.0	1.00	1.7	1.0	1.92e-11, 2.33e-11	
	20-Sep-06	-	1.0	0.2	0.08	0.2	2.5	4.80e-11, 5.84e-11	5×10^{-11}
			2.0	0.5	0.24	0.7	2.1	4.00e-11, 4.87e-11	
			3.0	1.0	0.50	1.7	2.0	3.84e-11, 4.67e-11	
SSP-04	22-Jul-05	29.98	1.0	0.2	0.22	0.2	0.9	1.74e-11, 2.12e-11	2×10^{-11}
			2.0	0.5	0.70	0.7	0.7	1.37e-11, 1.67e-11	
			3.0	1.0	1.40	1.7	0.7	1.37e-11, 1.67e-11	
	20-Sep-06	-	1.0	0.2	0.20	0.2	1.0	1.92e-11, 2.34e-11	2×10^{-11}
			2.0	0.5	0.45	0.7	1.1	2.13e-11, 2.60e-11	
			3.0	1.0	0.85	1.7	1.2	2.26e-11, 2.75e-11	
SSP-05	20-Sep-06	-	1.0	0.2	0.02	0.2	10.0	1.92e-10, 2.34e-10	1×10^{-10}
			2.0	0.5	0.06	0.7	8.3	1.60e-10, 1.95e-10	
			3.0	1.0	1.10	1.7	0.9	1.75e-11, 2.12e-11	
SSP-06	20-Sep-06	-	1.0	0.2	0.025	0.2	8.0	1.54e-10, 1.87e-10	1×10^{-10}
			2.0	0.5	0.070	0.7	7.1	1.37e-11, 1.67e-11	
			3.0	1.0	0.125	1.7	8.0	1.54e-10, 1.87e-10	
SSP-07	20-Sep-06	-	1.0	0.2	0.025	0.2	8.0	1.54e-10, 1.87e-10	1×10^{-10}
			2.0	0.5	0.080	0.7	6.3	1.20e-10, 1.46e-10	
			3.0	1.0	0.170	1.7	5.9	1.13e-10, 1.37e-10	

TABLE 2
SUMMARY OF SUB-SLAB PNEUMATIC TESTING DATA
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Notes:

in Hg - inches of mercury
inches H_2O - inches of water
min - minutes
L/min - litres per minute
L - litres
L/min/in H_2O - litres per minute per inches of water
m^2 - square meters

$$k = \frac{Q}{H}\frac{\mu}{P_w \pi}\frac{\ln(R_w / R_I)}{\left[1-(P_{atm}/P_w)^2\right]}$$

parameter	definition	value	conversion factor / comment
k	- permeability	calculated	1 m^2 = 1x10^4 cm^2
Q	- flow rate	measured	1 cm^3/s = 1L/min x (1000 cm^3/L) / (60 s/min)
H	- screened interval	5.1	
μ	- gas viscosity	0.000182	
Pw	- well pressure	measured	Pw = (406.8 in H_2O - well vacuum[in H_2O]) x (1.01 x 10^6 g/cm/s^2) / (406.8 in H_2O)
Patm	- atmospheric pressure	1.01E+06	1.01x10^6 g/cm/s^2 = 406.8 in H_2O
R_w	- well radius	0.64	
R_I	- radius of influence	100.0	permeability calculation is not sensitive to selected value for R_I

TABLE 3
SUMMARY OF PETROLEUM VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Sample Location	Sample Date	Petroleum Volatile Organic Compounds															
		TPH (gasoline)		Benzene		Toluene		Ethylbenzene		o-Xylene		m/p-Xylene		1,2,4-Trimethylbenzene		1,3,5-Trimethylbenzene	
units		ppmv	mg/m3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3	ppbv	ug/m^3
SSP-01	7/22/2005	1900	7800	1900	6100	840	3200	<260	< 1100	270	1200	750	3300	<560	< 2800	<260	< 1300
	7/22/2005 *	1500	6100	1600	5100	510	1900	<200	< 870	<200	< 870	470	2000	<400	< 2000	<200	< 990
	9/19/2006	870	3600	830	2700	<5.8	< 22.0	<5.8	< 25	<5.8	< 25	39	170	<12	< 59	<5.8	< 29
SSP-02	9/20/2006	9.4	39	<0.76	< 2.4	<0.76	< 2.9	<0.76	< 3.3	<0.76	< 3.3	<1.5	< 6.5	<1.5	< 7.4	<0.76	< 3.7
SSP-03	7/22/2005	<4.5	<18	1.3	4.2	1.8	6.8	<0.75	< 3.3	<0.75	< 3.3	<1.5	< 6.5	14	69	2.6	13.0
	9/20/2006	<4.2	<17	<0.70	< 2.2	1.1	4.2	<0.70	< 3.0	<0.70	< 3.0	1.7	7.4	3.4	17	0.81	4.0
SSP-04	7/22/2005	<4.8	<20	4.7	15.0	1.3	4.9	<0.80	< 3.5	<0.80	< 3.5	<1.6	< 7.0	<1.6	< 7.9	<0.80	< 3.9
	9/20/2006	<4.6	<19	<0.77	< 2.5	0.87	3.3	<0.77	< 3.4	<0.77	< 3.4	<1.5	< 6.5	<1.5	< 7.4	<0.77	< 3.8
SSP-05	9/20/2006	<4.6	<19	<0.76	< 2.4	7.3	28	<0.76	< 3.3	3.0	13.0	5.5	24	11	54	5.3	26
SSP-06	9/20/2006	660	2700	2300	7400	<30	< 110	<30	< 130	<30	< 130	<60	< 260	300	1500	<30	< 150
	9/20/2006 *	630	2600	1700	5400	<31	< 120	<31	<130	<31	< 130	74	320	370	1800	<31	< 150
SSP-07	9/20/2006	18	74	17	54	1.6	6.1	1.0	4.4	0.95	4.1	2.3	10	<1.4	< 6.9	<0.69	< 3.4
AA01	7/22/2005	<4.6	<19	<0.76	< 2.4	<0.76	< 2.9	<0.76	< 3.3	<0.76	< 3.3	<1.5	< 6.5	<1.5	< 7.4	<0.76	< 3.7
	9/20/2006	<4.3	<18	<0.72	< 2.3	<0.72	< 2.7	<0.72	< 3.1	<0.72	< 3.1	<1.4	< 6.1	<1.4	< 6.9	<0.72	< 3.5
Method Blank	7/22/2005	<3.0	<12	<0.50	<1.6	<0.50	<1.9	<0.50	<2.2	<0.50	<2.2	<1.0	<4.4	<1	<4.9	<0.50	<2.5

* Duplicate Sample

Concentration Units Conversion Factor

C[ug/m3] = C[ppbv] * MW/24.4 MW = Molecular Weight

Compound	MW	MW/24.4
Benzene	78.1	3.2
Toluene	92.1	3.8
Ethylbenzene	106.2	4.4
Xylene	106.2	4.4
Trimethylbenzene	120.2	4.9
TPH	100	4.1

Note: Molecular weight for TPH is estimated

TABLE 4
SUMMARY OF FIXED GASES ANALYTICAL RESULTS
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Constituent	Sample Date	Biodegradation Indicators		
		Oxygen	Methane	Carbon Dioxide
units		%	%	%
SSP-01	7/22/2005	1.4	1.7	14.7
	7/22/2005 *	1.4	1.7	14.7
	9/19/2006	2.53	0.319	13.8
SSP-02	9/20/2006	5.36	<0.151	7.65
SSP-03	7/22/2005	8.0	<0.2	9.6
	9/20/2006	10.9	<0.139	7.83
SSP-04	7/22/2005	2.1	<0.2	16.7
	9/20/2006	9.63	<0.153	10.0
SSP-05	9/20/2006	13.7	<0.152	3.50
SSP-06	9/20/2006	3.86	1.42	10.4
	9/20/2006 *	4.26	1.35	10.3
SSP-07	9/20/2006	4.09	<0.137	11.7
AA01	7/22/2005	21.9	<0.2	<0.2
	9/20/2006	21.9	<0.143	<0.143
Method Blank	7/22/2005	<0.1	<0.1	<0.1

* Duplicate Sample

TABLE 5
SUMMARY OF METHANE SCREENING RESULTS
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

ID	Location	CH_4 (%)	LEL (%)	Comments
CH4-01	SVP-02 Protective Casing	0.0	0.0	Well casing full of water.
CH4-02	Storm Sewer Grate	0.0	0.0	
CH4-03	MW-4 Protective Casing	0.0	0.0	Casing half full of water.
CH4-04	SVP-01 Protective Casing	0.0	0.0	Well casing full of water.
CH4-05	Storm Sewer Grate	0.0	0.0	
CH4-06	MW-41 Protective Casing	0.0	0.0	Casing half full of water.
CH4-07	MW-3 Protective Casing	15.5 (max)	OR	Casing half full of water.
CH4-08	MW-9 Protective Casing	6.5	OR	Casing half full of water.
CH4-09	Under Building at Crawl Space	0.0	0.0	
CH4-10	SVP-04 Protective Casing	0.0	0.0	Casing half full of water.
CH4-11	Unknown Access Hole	0.0	0.0	
CH4-12	MW-34 Protective Casing	0.0	0.0	Casing half full of water.
CH4-13	Electrical Access	0.3	5.0	
CH4-14	SVP-03 Protective Casing	0.0	0.0	Well casing full of water.
CH4-15	Valve Box	14.1	OR	Well casing full of soil. No sign of valves.
CH4-16	Control Valve Box	0.0	0.0	
CH4-17	Sanitary Sewer	0.0	0.0	
CH4-18	Crawl Space Access	0.0	0.0	Dropped tubing ~ 4' down into crawl space.
CH4-19	Electrical Outlet Hole in Break Room	0.0	0.0	

Notes:
% - percent
CH_4 - methane
LEL - lower explosive limit
OR - out of range

TABLE 6
SUB-SLAB SOIL GAS RISK BASED CONCENTRATION CALCULATION INPUT PARAMETERS
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

Parameter	Symbol	Default Value	Reference
Air Risk Based Concentration (ug/m^3)	RBC_{air}	Chemical-Specific	DEQ, 2003 Appendix A. Listed in Table 7
Area of Building (cm^2)	A_B	4.7 E+06	53 ft x 95 ft area of building with slab
Soil gas volumetric flow rate (L/min)	Q_{soil}	23.4	Based on 5 L/min per 100 m2 building area; USEPA Vapor Intrusion Guidance (USEPA, 2002)
Depth to soil gas sample (cm)	L_{cb}	15.5	0.5 ft x 30.5 cm/ft - sub-slab sample
Foundation wall thickness (cm)	L_{crk}	15	DEQ, 2003 Appendix C
Foundation crack fraction	f_{crk}	0.001	DEQ, 2003 Appendix C
Soil porosity	n	0.38	DEQ, 2003 Appendix C
Soil air filled porosity	n_a	0.26	DEQ, 2003 Appendix C
Soil water filled porosity	n_w	0.12	DEQ, 2003 Appendix C
Crack air filled porosity	n_{acrk}	0.26	DEQ, 2003 Appendix C
Crack water filled porosity	n_{wcrk}	0.12	DEQ, 2003 Appendix C
Building air exchange rate (1/day)	ER	48	DEQ, 2003 Appendix C
Building height (cm)	L_B	300	DEQ, 2003 Appendix C
Henry's law coefficient	H	Chemical-Specific	DEQ, 2003 Appendix D
Diffusion coefficient in air (cm^2/s)	Dair	Chemical-Specific	DEQ, 2003 Appendix D
Diffusion coefficient in water (cm^2/s)	Dwater	Chemical-Specific	DEQ, 2003 Appendix D

TABLE 7
SUB-SLAB SOIL GAS RISK BASED CONCENTRATIONS
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

	CAS No.	Mol. Wt.	RBC_air	α	RBC_soil gas	
Chemical		**g/mol**	**ug/m^3**		**ug/m^3**	**ppbv**
Benzene	71432	78	1.5	5.0E-04	3,000	941
Toluene	108883	92	1600	5.0E-04	3,200,000	851,000
Ethylbenzene	100414	106	4200	5.0E-04	8,420,000	1,940,000
o-Xylene	95476	106	420	5.0E-04	842,000	193,000
m/p-Xylene	108383 106423	106	420	5.0E-04	843,000	194,000
1,2,4 Trimethylbenzene	95636	120	25	5.0E-04	50,200	10,200
1,3,5 Trimethylbenzene	108678	120	25	5.0E-04	50,200	10,200
TPH-g	TPH-G	100	2600	5.0E-04	5,220,000	1,270,000

Notes:

RBC_air taken from ODEQ RBDM Guidance Document

Vapor intrusion attenuation factor, α, calculated using Johnson Ettinger Model with parameters listed in Table 6

RBC_soil gas = RBC_air / α

TABLE 8
AREA-WEIGHTED AVERAGE CONCENTRATIONS USING THIESSEN METHOD
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

ID	Probe ID	Area (ft^2)	TPH (gasoline) (ug/m^3)	Benzene (ug/m3)	Toluene (ug/m3)	Ethylbenzene (ug/m3)	o-Xylene (ug/m3)	m/p-Xylene (ug/m3)	1,2,4-Trimethylbenzen (ug/m3)	1,3,5-Trimethylbenzen (ug/m3)
1	SSP-01	490	7,800,000	6100	3200	550	1200	3300	1400	650
2	SSP-02	498	39,000	1.2	1.45	1.65	1.65	3.25	3.7	1.85
3	SSP-03	1615	9,000	4.2	6.8	1.65	1.65	7.4	69	13
4	SSP-04	3439	9,500	15	4.9	1.75	1.75	3.5	3.95	1.95
5	SSP-05	307	9,500	1.20	28	1.65	13	24	54	26
6	SSP-06	768	2,700,000	7400	60	65	65	320	1800	75
7	SSP-07	1084	74,000	54	6.10	4.40	4.1	10	3.45	1.7
Total Area (ft^2)		8200								
		Sumproduct	6041898740	8786595	1656568	333975	655379	1905233	2214776	414282
		Area Weighted Average	**736,817**	**1072**	**202**	**41**	**80**	**232**	**270**	**51**

$$\text{Sumproduct} = \sum(\text{Area} \times \text{Concentration})$$

Area Weighted Average = Sumproduct / Total Area

Thiessen Polygons used for averaging

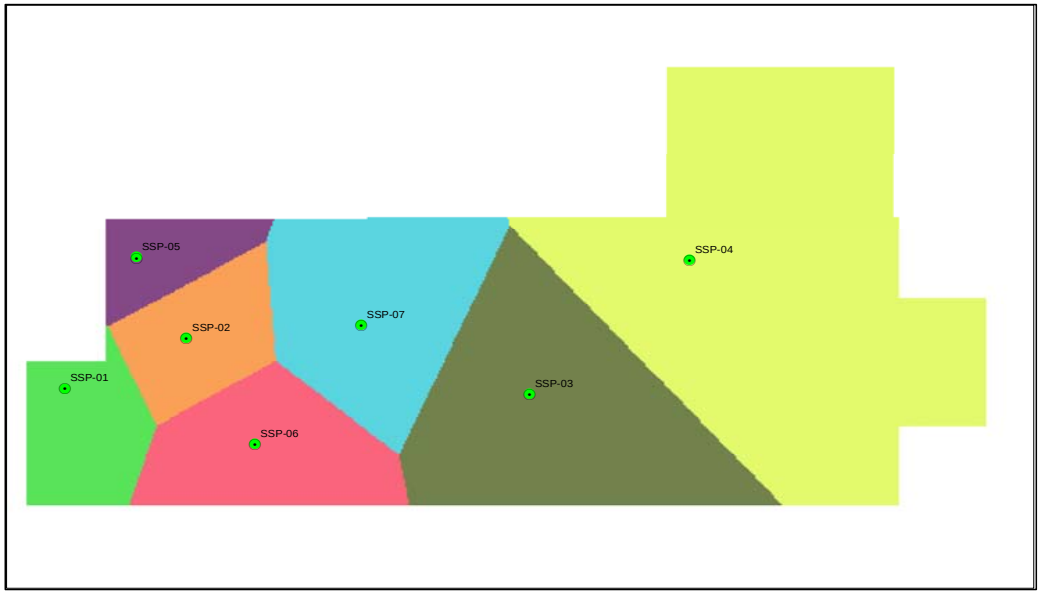
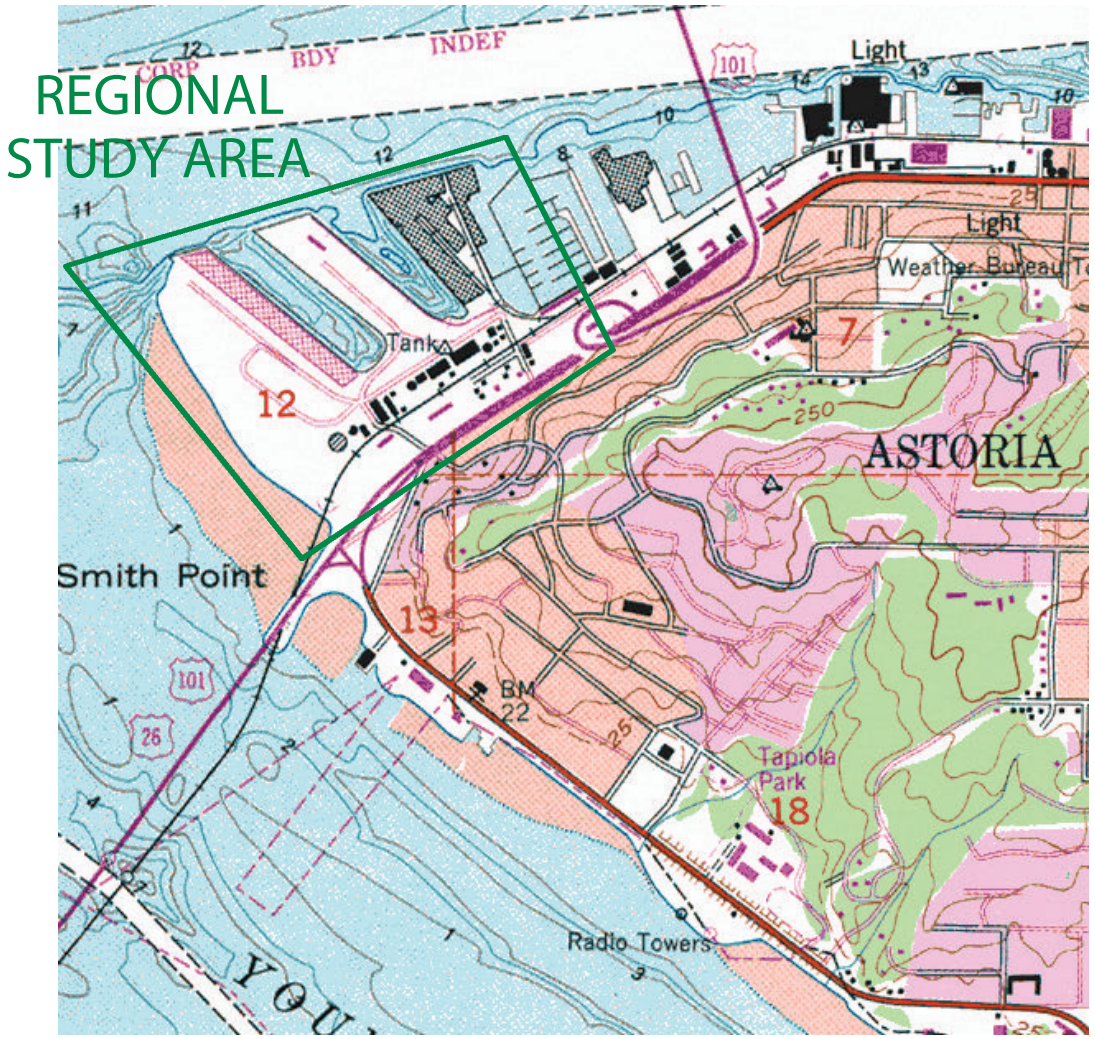


TABLE 9
RISK-BASED CONCENTRATION SCREENING
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

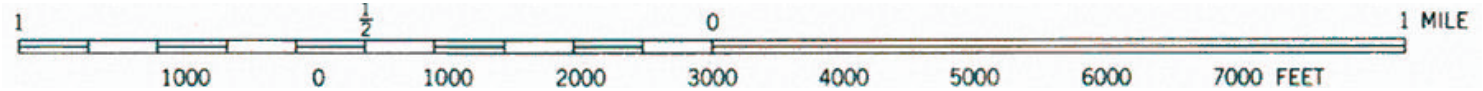
	RBC_soil gas	Maximum Concentration	Area-Weighted Average Concentration	Max. RBC Exceedance?	Avg. RBC Exceedance?
Chemical	**ug/m3**	**ug/m3**	**ug/m3**		
Benzene	3,000	7400	1100	**Yes**	No
Toluene	3,200,000	840	202	No	No
Ethylbenzene	8,420,000	550 [A]	41	No	No
o-Xylene	842,000	1200	80	No	No
m/p-Xylene	843,000	3300	230	No	No
1,2,4 Trimethylbenzene	50,200	1800	270	No	No
1,3,5 Trimethylbenzene	50,200	650 [A]	51	No	No
TPH-g	5,220,000	7,800,000	740,000	**Yes**	No

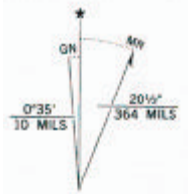
[A] Compound not detected. One-half the maximum detection limit listed.

FIGURES



(from USGS, Astoria {1984}, OR 7.5' Quadrangles)





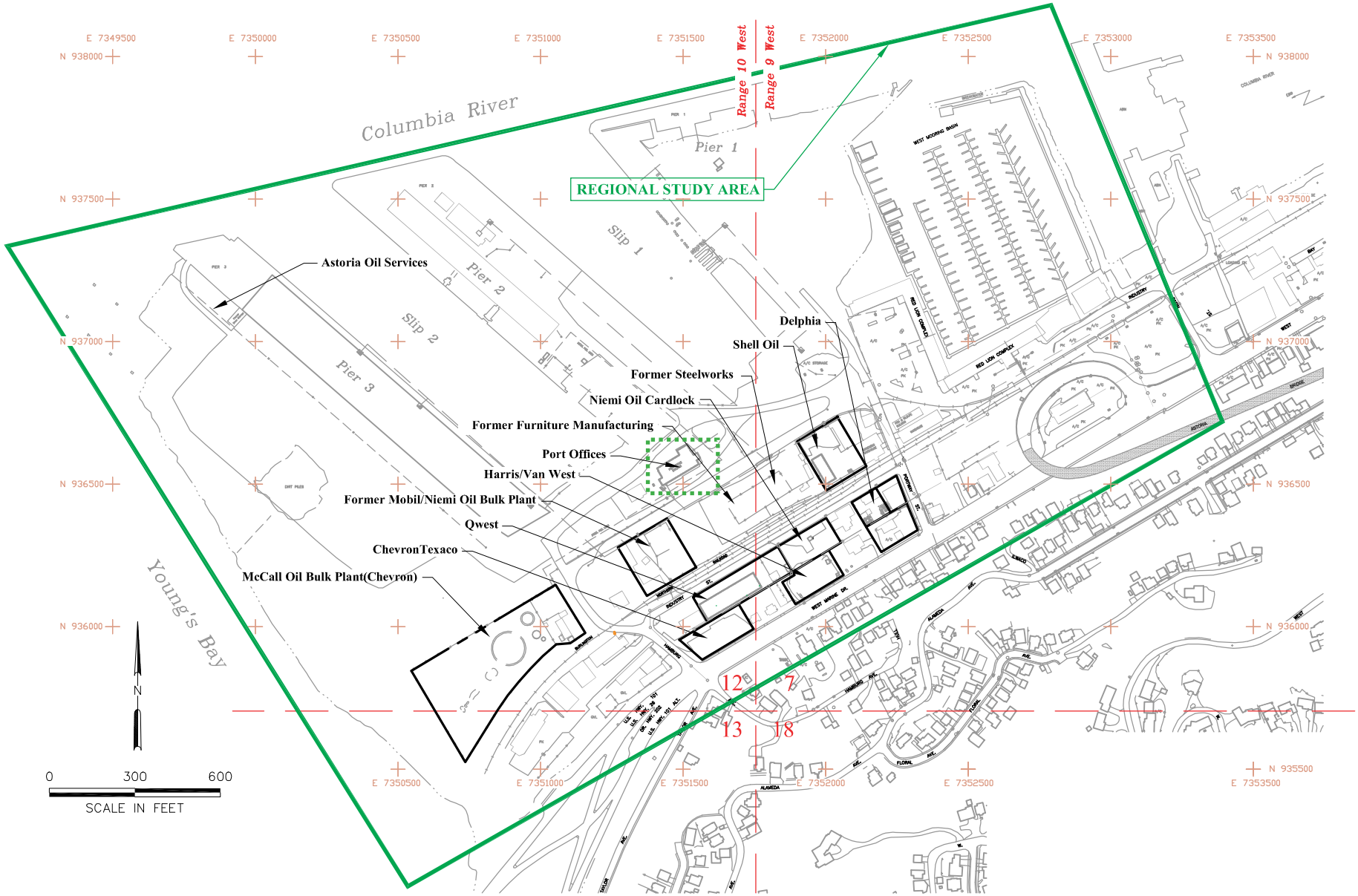


Source: Envirologic Resource Inc., Site Specific Health and Safety Plan

Site Location
Astoria Soil Vapor Survey, Astoria, Oregon

Aug. 2005	Figure: **1**	GeoSyntec Consultants

Site Map.ai



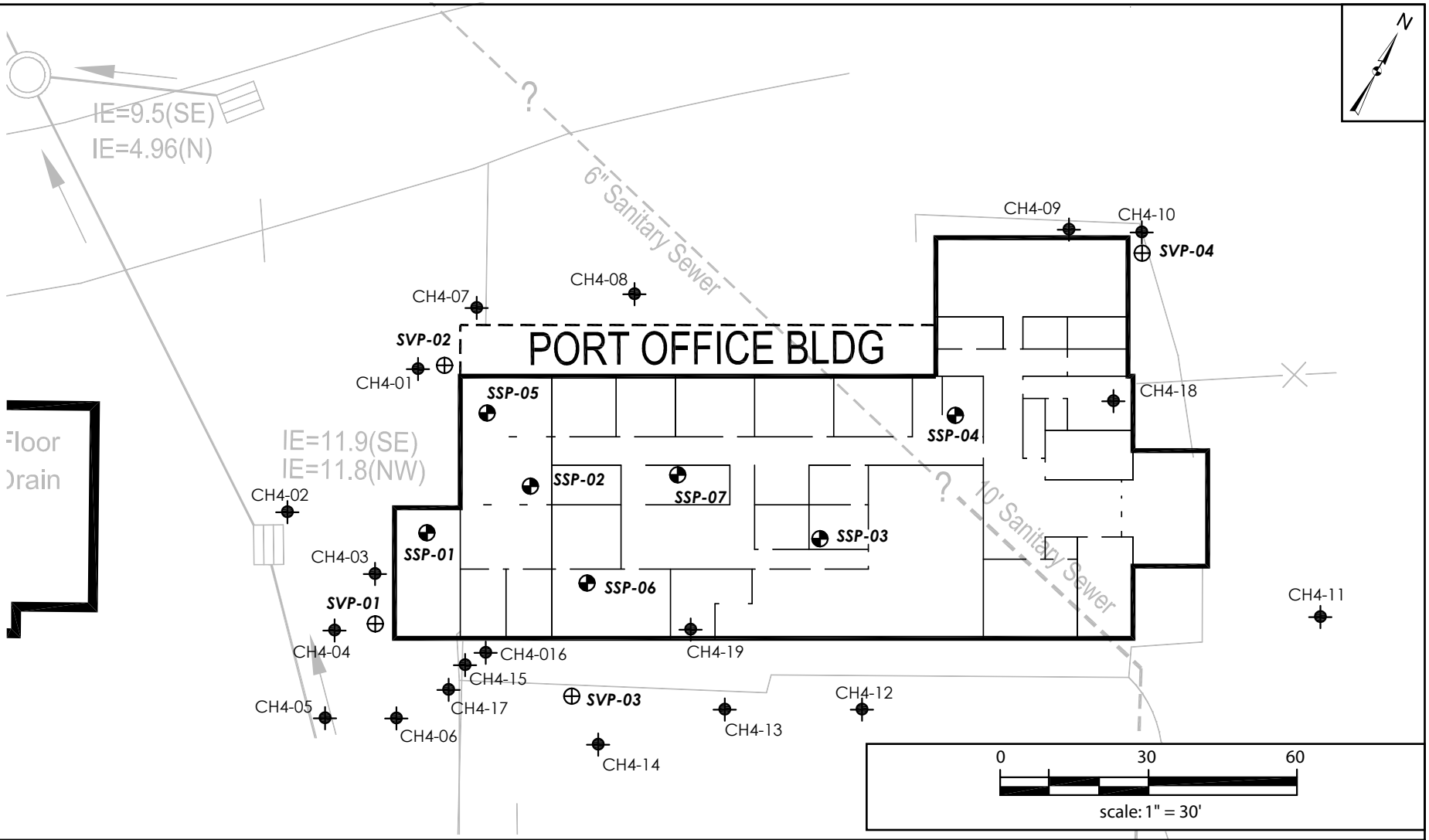
Investigation Area

Modified from: Envirologic Resource Inc., Site Specific Health and Safety Plan

Site Plan
Astoria Soil Vapor Survey, Astoria, Oregon

Aug. 2005	Figure: **2**	GeoSyntec Consultants

Site Plan.ai



Legend

SVP-04	⊕	Soil Vapor Probe Location
SSP-04	◒	Existing Sub-Slab Probe Location
CH4-03	⌖	Methane Monitoring Location

Source: Envirologic Resource Inc., Site Specific Health and Safety Plan

Soil Vapor Sample Locations
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site, Astoria, Oregon

Geosyntec consultants

Guelph | February 2007

Figure **3**

Sub-slab Locations.ai

Geosyntec consultants

APPENDIX A

GEOSYNTEC SUGGESTED OPERATING PROCEDURE FOR SUB-SLAB SOIL GAS MONITORING

SUGGESTED OPERATING PROCEDURE
SUB-SLAB SOIL GAS MONITORING

This document describes the suggested operating procedure (SOP) for sub-slab soil gas monitoring for the purpose of assessing the potential for subsurface vapor intrusion into indoor air. Sub-slab monitoring may include: subsurface gas sample collection for field screening and potential laboratory analysis, pneumatic monitoring to assess pressure differentials across the slab, and pneumatic testing to assess the gas permeability of the sub-slab materials. This SOP is intended to ensure high quality data collection, and identify possible biases and ways that they can be avoided.

1. OVERVIEW

Beneath most concrete floor slabs is a layer of granular fill material that is highly permeable and well-drained for structural purposes. This layer is normally also relatively permeable to soil gas, so in most cases, it is relatively simple to drill through the concrete floor and extract a sample of the sub-slab soil gas via vacuum for chemical analysis. Vapor intrusion assessments often benefit from collecting vertical profiles of vapor concentrations, and O_2/CO_2, so this SOP includes a method for installation of deeper probes also.

In some cases, the slab may be poured directly over on natural geologic materials, which may have a low permeability that inhibits soil gas flow and make sample collection difficult. This condition can be assessed with a simple pneumatic test, which is included in this SOP.

Depending on building ventilation and barometric pressure fluctuations, air can flow from below the floor slab to indoor air, or vice-versa, or flow intermittently in either direction. Pressure differentials across the floor slab can be assessed by instantaneous or continuous monitoring methods, which are also described in this SOP.

2. PROBE DESIGN AND INSTALLATION

Sub-slab probes (**Figure 1**, after EPA, 2004) are installed into the concrete slab to directly monitor the sub-slab soil gas. The probes have an insert consisting of a brass or stainless steel pipe. The pipe does not extend beyond the bottom of the slab. The probes have an air-tight fitting on the top that allows a threaded cap to seal the pipe and are set flush with the floor surface to minimize any trip hazard. The cap should be secured any time the probe is not being used for monitoring. The cap is removed and replaced with a brass or stainless steel valve with

male NPT threads on one side and a ¼-inch compression or barb fitting on the other side. All threaded couplings should be wrapped with Teflon™ tape to ensure air-tight seals.

Concrete floors are best drilled using a heavy-duty electrical hammer-drill. At least two different diameters of drill bits are required. 5/8-inch and 1-inch diameters. The 5/8-inch bit must be long enough to penetrate the floor slab (typically 6 inches, but occasionally up to 12 inches in industrial buildings). The 1-inch bit only needs to be a few inches in length.

Probe locations that are centrally located within areas of roughly 10 m by 10 m are generally recommended. This corresponds roughly to the footprint of a single-family residence. In large houses or commercial buildings, multiple samples may be appropriate to provide adequate assessment of spatial variability. The building owner should be consulted prior to deciding locations and which floor materials are acceptable to penetrate. Pre-tensioned concrete floors or subsurface utilities could be damaged by drilling or coring, so construction diagrams should be reviewed prior to selecting sample locations. Concrete dust generated during drilling should be collected during and after drilling using a wet/dry vacuum cleaner. If the floor is covered with carpet, a flap should be neatly cut with a sharp knife and lifted to access the concrete beneath, which can be secured after monitoring is complete with double-sided tape. If floor tiles are present, they should be cut with a tile-knife and lifted before drilling to avoid chipping to the extent practicable.

2.1 Installing Probe

A 5/8-inch diameter hole should be drilled until it punctures the floor slab and barely enters the underlying granular fill materials, but should not continue into the underlying geologic materials. A significant increase in the rate of the drill-bit penetration or decrease in resistance will usually indicate the bottom of the slab. The upper few inches of the hole should be reamed using a 1-inch bit. Dust will fall into the 5/8-inch hole as the reaming progresses, so the 5/8-inch bit should be used to clear the hole to the bottom of the slab after reaming the upper few inches. Upon completion of drilling, reaming, and clearing, the insert should be installed and sealed promptly to minimize any potential air flow into or out of the drilled hole. If the insert is not installed immediately the drilled hole should be plugged using plastic food wrap, tightly wedged into the hole to form an air-tight seal. Do not use any kind of tape with adhesives that may give off vapors.

The probe insert will be set in the drilled hole through the concrete and grouted into place using a swelling cement, commonly referred to as hydro-cement (available at building supply stores and normally used to seal cracks in concrete foundations). This cement expands as it sets, to form a good seal. Do not use silicone sealants, caulking, or any other material that could

potentially give off vapors. If the drilled hole diameter is large enough to allow the pipe to move freely, this may pose a risk that cement may flow down to the bottom of the pipe and plug the opening, in which case, wrap Teflon tape around the pipe near the bottom until it has sufficient diameter to contact the insides of the drilled hole tightly enough to prevent cement leakage past this "gasket". Set the pipe so that the threads are below the floor grade, and the cap is flush with the floor grade. The seal must be placed to allow the cap to be removed during monitoring events.

Cement seals should be allowed to set before sampling (typically less than an hour for fast-setting cement).

3. MEASUREMENT OF AMBIENT PRESSURE DIFFERENTIAL

The ambient pressure differential can be measured by connecting a valve to the probe insert, and attaching a vacuum gauge to the valve for an instantaneous reading, or attaching a digital micro-manometer with a pressure transducer and data-logger for continuous monitoring. In either case, the vacuum gauge should be zeroed and leveled according to the manufacturer's instructions prior to testing, and the zero should be confirmed after disconnecting the instrument at the end of the measurement period. If the zero shows any measurable drift, a drift correction may be necessary.

In most cases, the ambient pressure differential will be very small (typically less than 10 pascals (Pa), or 0.001 psi, or 0.03 in-H_2O. Manometers and diaphragm gauges are generally not capable of recording these small pressure differentials. Digital micro-manometers have been developed specifically for this range of measurement. Digital micro-manometers can be programmed to integrate readings over a period of time to minimize fluctuations attributable to minor transient air currents.

Monitoring the ambient pressure differential from sub-slab to indoor air can be combined with monitoring of barometric pressure trends over time to assess whether and to what degree barometric pumping influences the sub-slab to indoor air pressure differential. Digital barometers are also available that record barometric pressure (and temperature) over time. Monitoring of this kind may help with interpretation of indoor air quality data, providing the micro-manometer, barometer, and indoor air sample collection periods are all coincidental.

A list of suggested monitoring devices is provided in **Attachment 1**. The suggested equipment can be substituted with equivalent equipment, but it is the responsibility of the user to ensure that substitute equipment meets the requirements.

4. FLOW AND VACUUM CHECK

In most cases, the sub-slab materials are high-permeability granular fill materials, which yield soil gas under vacuum readily. However, a simple test can be conducted to confirm that the permeability of the sub-slab materials is sufficient to yield a representative sample in a reasonable period of time without excessive vacuum.

Soil gas samples for field screening or laboratory analysis typically require a volume of approximately 1 to 6 liters (L). Sample collection over 10 minutes to 1 hour is a reasonable period of time; therefore, a reasonable flow rate should be at least 200 millilitres per minute (mL/min). The flow rate will be proportional to the applied vacuum. Excessive vacuum can change the partitioning of vapors between pore water and soil gas; therefore, it should be avoided. Excessive vacuum will also increase the risk of leakage at the connection between the probe and the sample container, which can result in sample bias by the ingress of indoor air. Vacuum levels less than 1 in-H_2O should be low enough to avoid both concerns. Higher-level vacuum may be acceptable, but should be recorded and discussed with the data interpretation. Where a flowrate of at least 200 mL/min cannot be sustained with a vacuum less than 10 in-H_2O, it may be advisable to install and monitor an additional sub-slab probe to increase the confidence in the data.

To measure the soil gas flow and corresponding vacuum, the equipment should be assembled as shown on **Figure 2**, and in the photograph below:



1. Un-cap the probe and connect the monitoring attachment, which is comprised of a ball-valve with a ¼-inch compression fitting. Attach the most sensitive vacuum gauge, open the valve and record the ambient pressure or vacuum reading, along with the date and time. The vacuum gauge should be leveled and zeroed prior to connecting the tubing.

2. Assemble the components of the soil sampling equipment in the configuration shown on **Figure 2** (Vacuum and Flow Check Arrangement). Use new ¼-inch diameter HDPE, Teflon™ or Nylon tubing. Rotameters and vacuum gauges of several different ranges should be available, to ensure accurate readings, regardless of the gas permeability of the subsurface materials, which can span several orders of magnitude (see equipment list in **Attachment 1**)

3. A "shut-in" test should be conducted to ensure that there are no leaks prior to starting the flow and vacuum check. With the probe valve closed, create a vacuum of 50 to 100 in-H_2O within the sampling equipment apparatus by turning on the vacuum pump and then closing the ball valve on the influent side of the vacuum pump to maintain (i.e., "shut-in") the vacuum. Observe the vacuum gauge for at least 1 minute and if the vacuum does not dissipate, proceed to step 4. Otherwise, adjust each connection until there are no measurable vacuum decreases.

4. Release the vacuum in apparatus by opening the vent adjacent to the vacuum gauge. After the vacuum has dissipated, close the vent and open the ball valve on the monitoring attachment. Connect the most sensitive vacuum gauge and rotameter initially, followed by the others in succession, only if vacuum levels go beyond the scale.

5. Ensure the top fitting of the rotameter is connected to the valve on the vacuum pump intake and the direction of air-flow through the rotameter is from bottom to top. Flow is controlled by a valve at the influent to the vacuum pump, and fine-tuning valves integral to the rotameters. Fully open the rotameter valve initially and fully close the valve at the inlet of the vacuum pump before starting the pump. Set the flow rate to slightly higher than 1 liter per minute (L/min) using the valve at the pump intake, then use the rotameter valve to reduce the flow to about 200 mL/min. The rotameters must be vertical to accurately measure flow.

6. Record the flow rate and vacuum level as soon as both stabilize (typically within seconds). Depending on the gas permeability of the subsurface materials, it may be necessary to change the vacuum gauge (i.e., replace zero-to-0.25 in-H_2O gauge with zero-to-5 in-H_2O gauge) to ensure that both flow and vacuum are clearly measurable within the scales of the vacuum gauge and rotameter. If so, the valve at the top of the probe should be closed before any changes are made, to prevent any vacuum induced in the sub-slab region from pulling air backward through the sampling train, and the "shut-in" test should be repeated to confirm the absence of any noticeable leak.

7. Increase the flow rate to about 500 mL/min record the steady vacuum (typically after a few seconds of pumping). The ratio of flow rate divided by vacuum should be approximately constant and should be higher than 0.001 L/min/in-H_2O (i.e. >100 mL/min flow with <10 in-H_2O vacuum), otherwise, it may be appropriate to install another sub-slab probe to verify whether this low-permeability condition is localized (possibly even a plugged probe) or laterally continuous.

8. The flow and vacuum readings will stabilize almost instantaneously; therefore, the total volume of soil gas removed during the flow and vacuum test will be minimal. This is desirable, because excessive purging could potentially cause indoor air to flow into the sub-slab void space through any nearby discontinuities that may exist in the floor slab. A total volume of no more than a few liters should be removed during this test.

9. If indoor air sampling is also planned for the same site visit, exhaust gas from the vacuum pump should be routed to an outside location by an adequate length of tubing or through a trap filled with activated carbon. This will ensure that the subsequent indoor air

samples are not positively biased by any VOC vapors removed during the soil gas flow and vacuum test.

5. PURGING AND SAMPLE COLLECTION

Purging and sampling can proceed any time after the probe seal has set and the flow and vacuum measurements have been confirmed. The objective of purging is to ensure the collection of a "fresh" sample of sub-slab gas, not gas that has been stagnant within the probe or possibly introduced during the drilling and installation process. Field screening should generally be used to confirm steady readings, and to verify that the sample is reproducible. Tracer gas should also be used to ensure that there are no leaks in the probe seals, in addition to confirming absence of leaks using the "shut-in" test.

The recommend tracer gas is helium because it is non-toxic, readily available, easily field-screened using a portable instrument, and not a chemical that is known to be present in the subsurface at concentrations that could interfere with the portable instrument readings. The total volume of tracer gas to be added to the air-space under the shroud does not have to be large to be effective. For example, a helium cylinder open for several seconds will generally be sufficient to create concentrations in the shroud that are above 40% by volume. The air under the shroud should be screened with the portable monitoring device after adding the tracer, which can be done through a hole in the shroud. Other tracer gases that may be used include isobutylene, butane, or propane, providing the site does not have hydrocarbon vapors that could interfere with these compounds. The ionization potential of butane and propane are higher than most photoionization detector (PID) lamps, so a high-energy PID lamp, a flame ionization detector (FID), or a mobile gas chromatograph (GC) would be required.

Sampling for laboratory analysis will typically be performed using Summa canister. Summa canister samples can be collected by two methods: 1) connecting the Summa canister directly to the sub-slab probe after purging has demonstrated reproducible field screening readings, or 2) collecting a soil gas sample in a Tedlar bag, and then connecting the Tedlar bag to the Summa canister to transfer the sample to the Summa canister. The latter is recommended, because it allows the Tedlar bag to be screened for consistent FID or PID readings and presence of tracer gas before the Summa canister sample is collected, and if the tracer gas screening indicates a leak, the leak can be fixed and the purging and sampling repeated prior to sampling for laboratory analysis. The former method also requires a flow controller on the Summa canister, otherwise the strong vacuum of the Summa canister can draw moisture or particles into the canister. Flow controllers have a set flowrate that cannot be adjusted in the field, and may

not be appropriate for certain gas permeability conditions, which are typically not known in advance.

5.1 Preparation

Assemble the apparatus as shown in **Figure 2**, and the photograph below:



1. Connect the discharge of the vacuum pump to tubing that runs to an outdoor location to prevent any extracted gas from causing potential positive bias in any subsequent indoor air samples. If this is not practicable, the pump discharge can be collected in a large plastic garbage bag, secured to the pump discharge pipe with a hose-clamp during purging and sampling, and carried outside prior to emptying.

2. Calibrate field instruments, or perform a calibration check by measuring zero gas and span gas samples, each stored in dedicated Tedlar bags. Field screening should be done using an FID or PID at a minimum, but may also include O_2/CO_2 readings, an explosimeter, etc., depending on the site-specific chemicals of concern. A helium meter is also recommended for tracer gas screening.

3. Perform an equipment blank screening to ensure the absence of detectable PID or FID readings. Attach the Tedlar bag to the tubing inside the lung-box and open the Tedlar bag's valve and connect to an appropriate length (1 to 2 ft.) of ¼-inch HDPE, Teflon™ or Nylon tubing (sufficient to connect the lung box to the sub-slab probe without kinks). Secure the lid of the lung box and evacuate the lung box using the vacuum pump to fill

the Tedlar bag with ambient air. When the Tedlar bag is almost full, turn off vacuum pump, remove the Tedlar bag from the lung-box and screen the Tedlar bag for VOCs with the PID. If the Tedlar bag contains detectable VOCs, empty the bag and repeat this step until there are no measurable readings or replace the Tedlar bag and tubing with new materials and repeat.

4. In advance of purging, prepare the Summa canister. One-litre Summa canisters are preferred, because this volume is sufficient for the detection limits required to meet screening levels, and they are easier to handle and are less subject to risks of over-purging than 6-litre Summa canisters. Record the registration number on the sample log form. Remove the cap from the Summa canister, making sure that the valve is still closed. Attach the vacuum gauge via Swagelock™ fitting and turn ¼ turn past snug. Open the valve and record the initial vacuum, which should be about 27 to 30 inches of mercury (otherwise, the Summa canister may have leaked during shipping and should not be used). Close the valve, remove the vacuum gauge and connect the 5-micron stainless steel filter via Swagelock™ fitting and turn ¼-turn past snug.
    a. If the Summa canister sample will be collected by sub-sampling from a Tedlar bag sample, use a compression fitting to attach the septum to the 5-micron filter via Swagelock™ fitting, turned ¼ turn past snug, in preparation for attachment to the Summa canisters.
    b. If the Summa canister sample will be collected by direct connection to the sub-slab probe, connect a laboratory-certified flow controller to the 5 micron filter via Swagelock™ fitting, and turn ¼ turn past snug.

5.2 Purging and Field Screening

1. Connect a short (~1 ft) length of new, ¼-inch HDPE or Nylon tubing to the ball valve on the top of the probe using compression or barbed fitting. Slide the tubing through a 1/4-inch hole drilled through the top of a large (3 to 10 L) clear plastic container, which will act as a shroud for the tracer gas, attach this to a ball valve. Connect another short (~4 inch) length of new, ¼-inch HDPE, Teflon™ or Nylon tubing to the other side of this ball valve, and slide it through the wall of the lung box using a compression fitting, as shown in **Figure 2**. Attach a 1L Tedlar bag to the end of this tubing with a compression or barbed fitting, open the valve on the Tedlar bag, and secure the bag within the lung box.

2. Open the valve at the top of the sub-slab probe, and position the shroud centrally over the probe and valve, adjusting the tubing to minimize any tension.

3. Connect the evacuation port on the lung box to the vacuum pump. The tubing for this can be re-used, because the sample never comes into contact with the gas that will be sampled.

4. Inject helium into the shroud through the injection port on one side of the shroud, and monitor the concentration of helium inside the shroud by inserting the intake of the helium meter into the sampling port on the other side of the shroud. Continue adding helium until the concentration within the shroud is in the range of 60 to 100% by volume.

5. Check that the valve at the inlet of the vacuum pump is closed, then turn on the pump and open the valve at the head of the pump slowly, until the rotameter reading is in the range of 200 to 500 mL/min, preferably with a vacuum of <1 in H_2O. The flow and vacuum test procedure (described above) should be used to select the best compromise between flow-rate and vacuum, if the gas permeability is low.

6. When the Tedlar bag is nearly full, close the valve outside the shroud in the line between the probe and the Tedlar bag, then turn off the pump, vent the lung box (crack the seal to relieve the vacuum), and disconnect the tubing from the compression or barbed fitting at the downstream end of the valve outside the shroud. Connect the tubing from the Tedlar bag to the calibrated field instruments (helium meter, PID or FID, O2/CO2, explosimeter, etc.) in sequence and record the time and stable readings on the sampling form (attached).

7. It is important that the Tedlar bag contents be at ambient pressure for both calibration and screening readings. If the bag is pressurized, the flow rate through the portable instrument may increase and result in variable readings. Any remaining Tedlar bag contents should be exhausted to outdoor air, so indoor air samples are not positively biased by emptying the Tedlar bag indoors.

8. If the concentration of helium in the Tedlar bag sample from the sub-slab probe is greater than 5% of the concentration in the shroud in two successive Tedlar bag samples, the probe seal and valve should be reviewed to determine whether there is a leak. If there appears to be a leak through the probe seal, it may be possible to minimize the leak by adding water to the seal between the probe and the floor slab or a paste of bentonite and water around the top of the probe. Otherwise the probe may need to be replaced.

9. Repeat the purging and field screening procedure for a minimum of 3 readings. PID/FID readings should be stable, indicating a reproducible sample. If PID/FID readings are decreasing, it may indicate the influx of indoor air (even in the absence of significant levels of tracer gas in the sample, possibly due to a crack in the floor just outside the

shroud). An atmospheric air leak may also be indicated by decreasing O_2 and increasing CO_2 concentrations at sites with aerobically degradable compounds. If atmospheric air leaks are suspected by these trends in the field screening data, the probe should be allowed to re-equilibrate for at least an hour, and subsequent sampling should be completed after purging of a single Tedlar bag sample. If there are no detectable PID or FID readings it is not possible to confirm steady readings, but the absence of significant concentrations of tracer gas will verify that the samples are representative of the sub-slab zone.

5.3 Summa Canister Sample Collection

1. If field screening readings are stable after 3 Tedlar bag samples, samples should be collected for laboratory analysis. Collect the Summa canister sample first, via one of the following two options:
    a. Preferred Option: collect one additional Tedlar bag sample, screen it with the helium meter to confirm absence of leaks, and then connect the Tedlar bag directly to the Summa canister using compression fittings. Open the Summa canister valve slowly and close it again before the bag is completely drained.
    b. Alternate Option: Lift the shroud, close the valve at the top of the sub-slab probe, remove the tubing and connect the flow controller of the Summa canister to the probe valve directly with compression or barb fittings to as short as possible piece of ¼-inch HDPE, Teflon™ or Nylon tubing to minimize the dead volume. Open the valve on the probe, then open the valve on the canister. The Summa canister should fill within 5 minutes if the flow controller was set to 200 ml/min (recommended), unless the gas permeability of the subsurface materials is low, in which case, additional time should be allowed, using judgment and review of the flow and vacuum testing data. After allowing sufficient time for the sample to be collected, close the valve on the Summa canister, then close the valve on the probe.

2. Remove the 5-micron filter (and flow controller, if used) from the Summa canister, and replace it with the vacuum gauge (¼ turn past snug). Re-open the valve on the Summa canister and record the final vacuum (should be less than a few inches of mercury, but may also be zero). Close the Summa valve, remove the vacuum gauge, and replace the cap on the Summa canister valve in preparation for return shipping. Double check that the cap and valve on the Summa are tightly closed. Record the final vacuum on the sampling form and the chain of custody.

3. The label tag on the Summa canister should be filled-out with the site name, sample ID#, sampler's name, project code, and date and time of sample.

4. Remove the valve from the sub-slab probe replace it with the cap, freshly wrapped with new Teflon tape.

This procedure should be repeated for each sub-slab soil gas probe.

6. CHAIN OF CUSTODY AND SAMPLE HANDLING

The label tag on the mini-Summa canister should be filled-out with the site name, sample ID #, sampler's name, project code, date and time of sample, initial and final vacuum levels, and analysis requested. A chain of custody (COC) form should be completed with each sample shipment. The COC should include the sample ID, canister number, analysis requested, and any special instructions. The laboratory will confirm the final vacuum level for each Summa canister upon receipt to verify that the Summa canister valve and cap did not leak during shipment. Canisters do not need to be refrigerated, but should be shipped with sufficient padding to prevent damage if the container is accidentally dropped.

The COC form should be signed by the sampler and placed in the shipping container, then the shipping container should be wrapped securely using packing tape. The sampler should sign the packing tape across the seam of the lid of the container, so it cannot be opened without damaging the signature. Upon arrival, the laboratory will confirm the signature to be intact, and complete the COC form. Analyses should be scheduled with the analytical laboratory to be completed within acceptable holding times. Summa canisters should be analyzed within 2 weeks.

7. FIELD QC SAMPLES FOR SOIL GAS SAMPLE COLLECTION

Field quality control (QC) samples should be collected to monitor sampling and analytical performance. A complete record of all QC samples collected must be maintained as a part of the sampling documentation. The definition and purpose of each type of QC sample, and the procedures for their collection and handling are described in the paragraphs below.

Ambient Air Screening: Before field screening at each soil gas probe, an ambient air sample will be screened by drawing ambient air into a PID or FID over a period of at least one minute

and recording the range of readings occurring during that time period. This ambient air screening should provide no detectable concentrations, but any readings observed may be useful to identify background conditions and evaluate potential biases.

Equipment Blanks: Prior to purging, an equipment blank should be performed to ensure the absence of measurable VOC vapors. Disconnect the tubing from the valve on top of the soil gas probe, and fill the Tedlar Bag with zero gas (preferred) or outdoor air through the tubing. Equipment blank readings should be made using a PID or FID, calibrated to span gas and zero gas according to manufacturers instructions. Atmospheric air may be used as zero gas in areas of generally good air quality, but should be avoided in high traffic areas, smog areas, or areas with any noticeable odors. If the equipment blank reading is above the FID or PID detection limit, repeat the equipment blank step with a new Tedlar bag and new length of tubing. If this does not result in a blank with no detectable VOCs, the FID or PID calibration should be repeated and the equipment blank process repeated. If this still does not provide an equipment blanks below the FID or PID detection limit, a project management decision will be required regarding whether to proceed with sampling, or whether to replace or perform service on the FID or PID.

Field Duplicate Sample: During the soil gas probe sampling, a field duplicate sample will be collected using regular sampling procedures immediately after collecting the investigative sample. The field duplicate sample will be analyzed to identify sample variability. The duplicate sample will be submitted for analyses without indication of which sample the duplicate represents (i.e., blindly). If the monitoring program includes multiple samples (i.e. Summa canister for VOCs, possibly Radon, etc.), the duplicate should also include the entire suite. Field duplicate samples are recommended at a frequency of one for every 10 investigative samples.

8. EQUIPMENT CLEANING

New or dedicated materials are preferred to minimize the risk of cross-contamination or carry-over from one sample to the next. The Tedlar bag may be re-used for field screening, but should be flushed using atmospheric air and completely drained three times between uses and verified clean by the equipment blank procedure. New or dedicated Tedlar bags are necessary if a Summa canister sample is to be drawn from a Tedlar bag after field screening. Brass and stainless steel valves should be heated and flushed with ample amounts of air to strip any residual VOCs between sampling events.

9. DOCUMENTATION

Field documentation will include instrument calibration information; date, time and location of readings; purging rate and vacuum induced; number of Summa canisters filled; sampler's name; and a detailed description of the equipment set up for each location. The series of field screening readings will be recorded on the sampling log sheets. A list of the soil gas probes sampled and the sampling order for all samples and QA/QC samples will be recorded on the sampling field records. Photographs are recommended to aid in recording equipment set-up.

For each sampling day, the following information will be recorded on the daily field logs

- name and number of project;
- name of field personnel;
- date and time of sampling event;
- list of the primary activities performed;
- identification of probes screened;
- time when soil gas samples were collected; and,
- all related information (weather, attendees, equipment problems, any departures from standard procedures and the reasons and responses) observed throughout the day.
- Field instrument information and calibration data;
- Value of probe dead space volume for each soil gas probe;
- Time, probe soil gas readings (and tubing blank reading) for each probe volume (or Tedlar™ bag filled); and
- Time and reading for each instrument calibration check.

10. REFERENCES AND SUGGESTED READING

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Attachment 1: Recommended Equipment

Tubing: High Density Polyethylene (HDPE) tubing is generally acceptable for low sorption (Barcelona et. al., 1983), and works well with compression fittings or barbed fittings. Nylon tubing is considered equally appropriate. Teflon™ tubing is considerably less flexible than HDPE and may not work as well with barbed fittings. Tubing may also be stainless steel or copper, which forms air-tight seals when used with Swagelock™ fittings, but is more expensive and less flexible than HDPE. Soft flexible tubing should be avoided (except for the discharge line from the pump discharge to an outdoor location, if used), because vapors tend to adsorb more strongly to them.

Rotameter-Style Flowmeters: Dwyer Model RMB-5-49 with a range up to 5 standard cubic feet per hour (SCFH) (2.4 L/min), and Model RMB-5-52 with a range up to 50 SCFH (24 L/min).

Vacuum Gauges: Dwyer Magnehelic™ gauges, which are available in several ranges, including zero to 0.25 in-H_2O, zero to 5 in-H_2O, and zero to 100 in-H_2O.

Vacuum Pump: GAST, DOA-P101-AA piston pump

Lung Box: Xitech Instruments, Inc. Model 1060 1 L Bag Sampler

Helium Meter: Mark 9822 helium detector

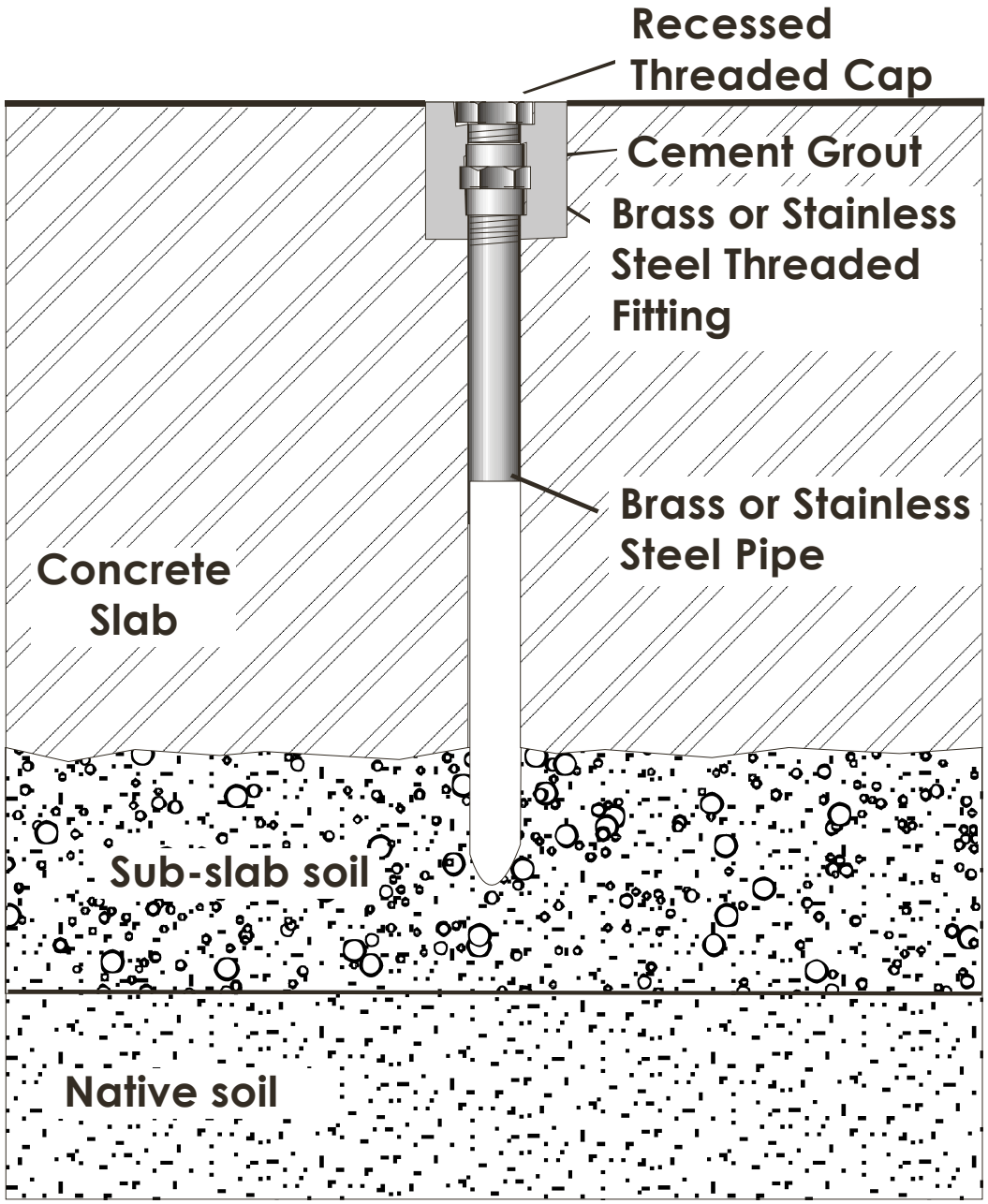
Portable FID/PID: Foxboro TVA 1000 FID/PID, miniRAE 2000, ppbRAE, Photovac Microtip.

Personal Sampling Pump: Sensidyne Gilian GilAir-3 Constant Flow Sampling Pump

ATD Tubes: supplied by laboratory, after discussion of target chemicals, relative concentrations, target detection limits, and potential ranges of concentrations.

Micro-manometer: Logtech DP-Calc digital micro-manometer

Barologger: Barnstead ERTCO Barometric Pressure data recorder.

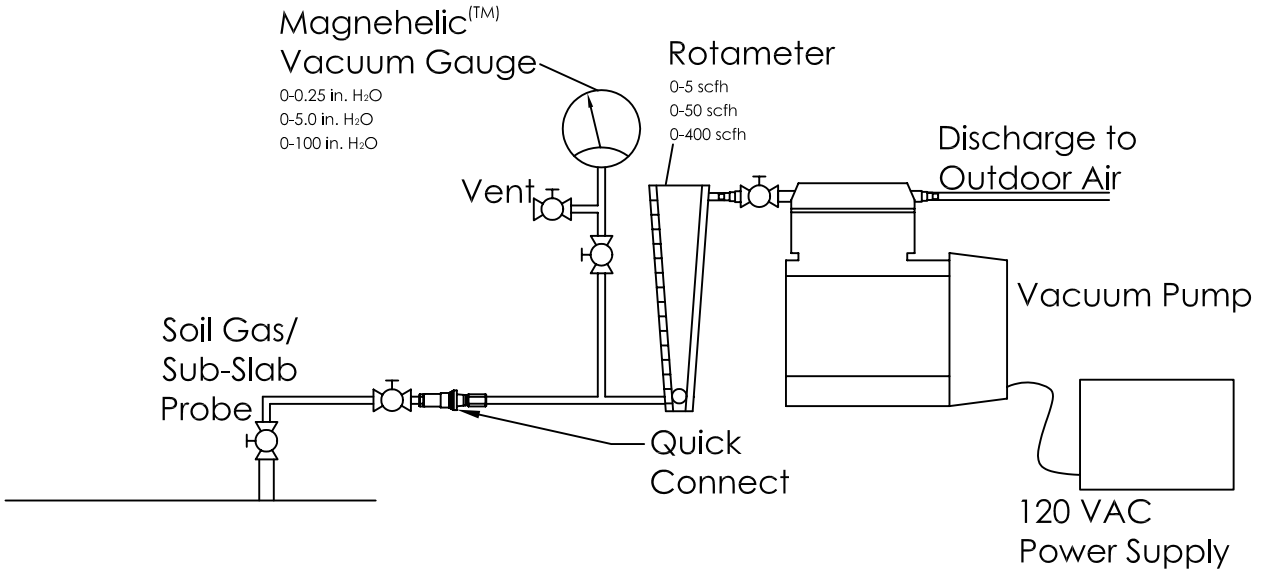


modified from EPA, 2004

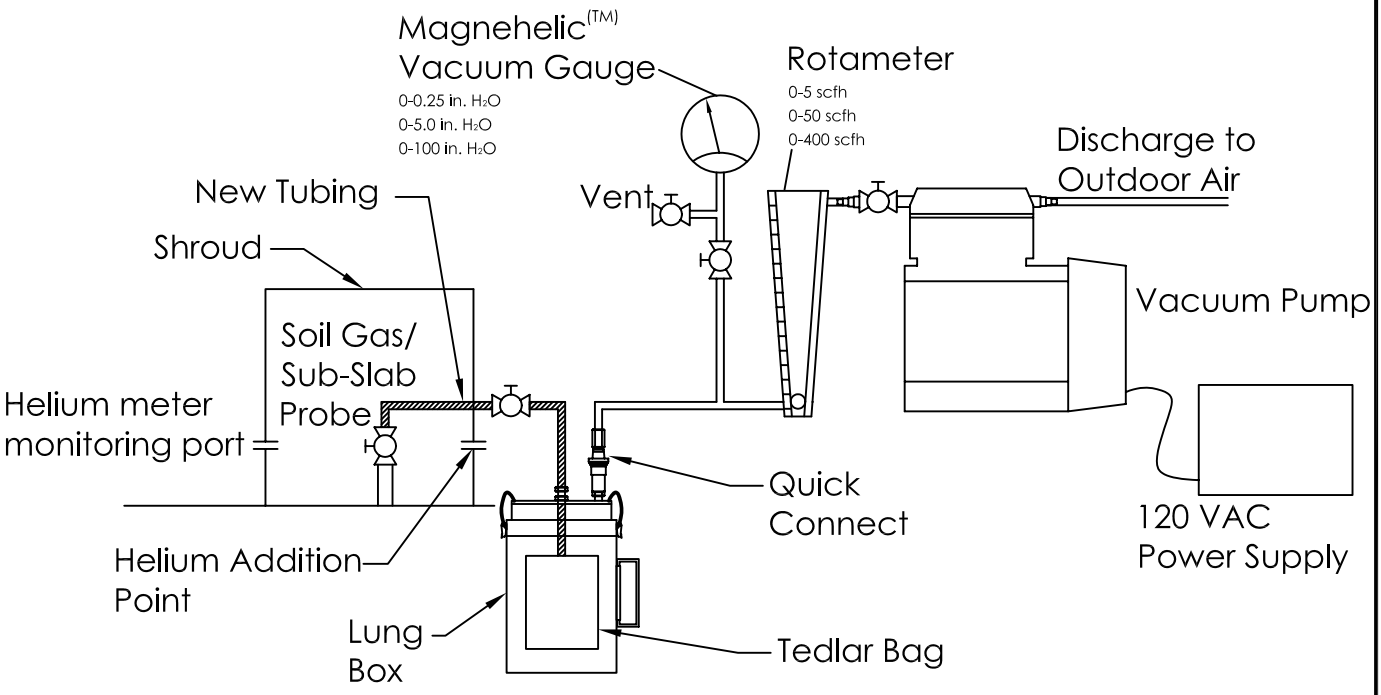
Sub-Slab Probe
GeoSyntec Consultants,
Suggested Operating Procedure

Jan 2005	Figure: **1**	GeoSyntec Consultants

sub-slab.ai



A - Flow and Vacuum Check



B - Purging and Sample Collection

High Density Polyethylene Tubing (HDPE), Nylaflow™, Teflon, Stainless Steel

Low Density Polyethylene Tubing (LDPE)

Soil Gas Sampling Apparatus

Jan. 2005 | Figure: **2** | GeoSyntec Consultants

P:\Graphics\GeoSyntec PROJECTS\TR0169\Lung box option with shroud.dwg

Geosyntec consultants

APPENDIX B

LABORATORY REPORTS OF ANALYSES

Calscience Environmental Laboratories, Inc.

August 05, 2005

Robbie Ettinger
GeoSyntec Consultants
924 Anacapa Street
Suite 4A
Santa Barbara, CA 93101-2177

Subject: **Calscience Work Order No.: 05-07-1353**
Client Reference: HX0186

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 7/25/2005 and analyzed in accordance with the attached chain-of-custody.

Unless otherwise noted, all analytical testing was accomplished in accordance with the guidelines established in our Quality Assurance Program Manual, applicable standard operating procedures, and other related documentation. The original report of any subcontracted analysis is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Stephen Nowak
Project Manager

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	07/25/05
924 Anacapa Street		Work Order No:	05-07-1353
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-3(M)

Project: HX0186 Page 1 of 1

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-01	**05-07-1353-1**	**07/22/05**	**Air**	**N/A**	**07/26/05**	**050726L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	1900	18	5.92		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-03	**05-07-1353-2**	**07/22/05**	**Air**	**N/A**	**07/26/05**	**050726L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	4.5	1.5		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-04	**05-07-1353-3**	**07/22/05**	**Air**	**N/A**	**07/26/05**	**050726L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	4.8	1.6		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-0X	**05-07-1353-4**	**07/22/05**	**Air**	**N/A**	**07/26/05**	**050726L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	1500	4	1.59		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
AA01	**05-07-1353-5**	**07/22/05**	**Air**	**N/A**	**07/26/05**	**050726L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	4.6	1.52		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
Method Blank	**098-01-005-322**	**N/A**	**Air**	**N/A**	**07/26/05**	**050726L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	3.0	1		ppm (v/v)

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	07/25/05
924 Anacapa Street		Work Order No:	05-07-1353
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-15
		Units:	ppb (v/v)
Project: HX0186			Page 1 of 1

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-01	**05-07-1353-1**	**07/22/05**	**Air**	**N/A**	**07/27/05**	**050727L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	1900	260	518		Toluene	840	260	518	
Ethylbenzene	ND	260	518		1,3,5-Trimethylbenzene	ND	260	518	
o-Xylene	270	260	518		1,2,4-Trimethylbenzene	ND	520	518	
p/m-Xylene	750	520	518						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-03	**05-07-1353-2**	**07/22/05**	**Air**	**N/A**	**07/27/05**	**050727L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	1.3	0.7	1.5		Toluene	1.8	0.7	1.5	
Ethylbenzene	ND	0.75	1.5		1,3,5-Trimethylbenzene	2.6	0.7	1.5	
o-Xylene	ND	0.75	1.5		1,2,4-Trimethylbenzene	14	1	1.5	
p/m-Xylene	ND	1.5	1.5						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-04	**05-07-1353-3**	**07/22/05**	**Air**	**N/A**	**07/27/05**	**050727L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	4.7	0.8	1.6		Toluene	1.3	0.8	1.6	
Ethylbenzene	ND	0.80	1.6		1,3,5-Trimethylbenzene	ND	0.80	1.6	
o-Xylene	ND	0.80	1.6		1,2,4-Trimethylbenzene	ND	1.6	1.6	
p/m-Xylene	ND	1.6	1.6						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-0X	**05-07-1353-4**	**07/22/05**	**Air**	**N/A**	**07/27/05**	**050727L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	1600	200	398		Toluene	510	200	398	
Ethylbenzene	ND	200	398		1,3,5-Trimethylbenzene	ND	200	398	
o-Xylene	ND	200	398		1,2,4-Trimethylbenzene	ND	400	398	
p/m-Xylene	470	400	398						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
AA01	**05-07-1353-5**	**07/22/05**	**Air**	**N/A**	**07/28/05**	**050727L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.76	1.52		Toluene	ND	0.76	1.52	
Ethylbenzene	ND	0.76	1.52		1,3,5-Trimethylbenzene	ND	0.76	1.52	
o-Xylene	ND	0.76	1.52		1,2,4-Trimethylbenzene	ND	1.5	1.52	
p/m-Xylene	ND	1.5	1.52						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
Method Blank	**095-01-021-3,191**	**N/A**	**Air**	**N/A**	**07/27/05**	**050727L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.50	1		Toluene	ND	0.50	1	
Ethylbenzene	ND	0.50	1		1,3,5-Trimethylbenzene	ND	0.50	1	
o-Xylene	ND	0.50	1		1,2,4-Trimethylbenzene	ND	1.0	1	
p/m-Xylene	ND	1.0	1						

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

ACCREDITED IN ACCORDANCE WITH nelac

ANALYTICAL REPORT

GeoSyntec Consultants		Date Sampled:	07/22/05
924 Anacapa Street		Date Received:	07/25/05
Suite 4A		Date Analyzed:	07/25/05
Santa Barbara, CA 93101-2177			
		Work Order No.:	05-07-1353
Attn: Robbie Ettinger		Method:	ASTM D-1946
RE: HX0186		Page 1 of 3	

All concentrations are reported in percent (%) by volume.

Analyte	Concentration	Reporting Limit
Sample Number: SSP-01		
Oxygen (O_2) + Argon (Ar)	1.4	0.1
Nitrogen (N_2)	82.2	0.1
Methane (CH_4)	1.7	0.1
Carbon Monoxide (CO)	ND	0.1
Carbon Dioxide (CO_2)	14.7	0.1
Sample Number: SSP-03		
Oxygen (O_2) + Argon (Ar)	8.0	0.2
Nitrogen (N_2)	82.4	0.2
Methane (CH_4)	ND	0.2
Carbon Monoxide (CO)	ND	0.2
Carbon Dioxide (CO_2)	9.6	0.2
Sample Number: SSP-04		
Oxygen (O_2)	2.1	0.2
Nitrogen (N_2)	81.2	0.2
Methane (CH_4)	ND	0.2
Carbon Monoxide (CO)	ND	0.2
Carbon Dioxide (CO_2)	16.7	0.2

Calscience Environmental Laboratories, Inc.

ACCREDITED IN ACCORDANCE WITH nelac

ANALYTICAL REPORT

GeoSyntec Consultants		Date Sampled:	07/22/05
924 Anacapa Street		Date Received:	07/25/05
Suite 4A		Date Analyzed:	07/25/05
Santa Barbara, CA 93101-2177			
		Work Order No.:	05-07-1353
Attn: Robbie Ettinger		Method:	ASTM D-1946
RE: HX0186		Page 2 of 3	

All concentrations are reported in percent (%) by volume.

Analyte	Concentration	Reporting Limit
Sample Number: SSP-0X		
Oxygen (O_2) + Argon (Ar)	1.4	0.2
Nitrogen (N_2)	82.3	0.2
Methane (CH_4)	1.7	0.2
Carbon Monoxide (CO)	ND	0.2
Carbon Dioxide (CO_2)	14.7	0.2
Sample Number: AA01		
Oxygen (O_2) + Argon (Ar)	21.9	0.2
Nitrogen (N_2)	78.1	0.2
Methane (CH_4)	ND	0.2
Carbon Monoxide (CO)	ND	0.2
Carbon Dioxide (CO_2)	ND	0.2

Calscience Environmental Laboratories, Inc.

ANALYTICAL REPORT

GeoSyntec Consultants		Date Sampled:	N/A
924 Anacapa Street		Date Received:	N/A
Suite 4A		Date Analyzed:	07/25/05
Santa Barbara, CA 93101-2177			
		Work Order No.:	05-07-1353
Attn: Robbie Ettinger		Method:	ASTM D-1946
RE: HX0186		Page 3 of 3	

All concentrations are reported in percent (%) by volume.

Analyte	Concentration	Reporting Limit
Sample Number: Method Blank		
Oxygen (O_2)	ND	0.1
Nitrogen (N_2)	ND	0.1
Methane (CH_4)	ND	0.1
Carbon Monoxide (CO)	ND	0.1
Carbon Dioxide (CO_2)	ND	0.1

QA/QC

Sample Number: Laboratory Control Sample

Analyte	Sample Conc.	Duplicate Conc.	%RPD	Control Limits (%)
Oxygen (O_2) + Argon (Ar)	20.0	20.8	4	0 - 30
Nitrogen (N_2)	75.5	78.0	3	0 - 30
Carbon Dioxide (CO_2)	5.11	5.01	2	0 - 30

Calscience Environmental Laboratories, Inc.

Quality Control - Duplicate

GeoSyntec Consultants
924 Anacapa Street
Suite 4A
Santa Barbara, CA 93101-2177

Date Received: 07/25/05
Work Order No: 05-07-1353
Preparation: N/A
Method: EPA TO-3(M)

Project: HX0186

Quality Control Sample ID	Matrix	Instrument	Date Prepared:	Date Analyzed:	Duplicate Batch Number
05-07-1393-4	**Air**	**GC 13**	**N/A**	**07/26/05**	**050726D01**

Parameter	Sample Conc	DUP Conc	RPD	RPD CL	Qualifiers
TPH as Gasoline	6000	6000	1	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

GeoSyntec Consultants
924 Anacapa Street
Suite 4A
Santa Barbara, CA 93101-2177

Date Received: N/A
Work Order No: 05-07-1353
Preparation: N/A
Method: EPA TO-15

Project: HX0186

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
095-01-021-3,191	**Air**	**GC/MS AA**	**N/A**	**07/27/05**	**050727L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Benzene	107	106	61-121	0	0-37	
Bromoform	88	85	62-134	3	0-38	
Carbon Tetrachloride	99	100	56-128	1	0-42	
1,2-Dibromoethane	91	86	63-123	5	0-38	
1,2-Dichlorobenzene	94	87	41-149	7	0-62	
1,2-Dichloroethane	101	100	63-123	2	0-37	
1,2-Dichloropropane	107	105	61-121	2	0-37	
1,4-Dichlorobenzene	89	84	51-147	5	0-49	
c-1,3-Dichloropropene	112	105	62-128	6	0-37	
Ethylbenzene	97	88	61-127	10	0-38	
o-Xylene	94	83	58-130	12	0-38	
p/m-Xylene	94	85	57-129	10	0-39	
Tetrachloroethene	85	91	59-119	6	0-40	
Toluene	92	91	60-120	1	0-39	
Trichloroethene	106	107	65-119	1	0-38	
1,1,2-Trichloroethane	113	99	64-124	13	0-37	
Vinyl Chloride	109	107	58-124	1	0-37	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Glossary of Terms and Qualifiers

Work Order Number: 05-07-1353

Qualifier	Definition
*	See applicable analysis comment.
1	Surrogate compound recovery was out of control due to a required sample dilution, therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike or Matrix Spike Duplicate compound was out of control due to matrix interference. The associated LCS and/or LCSD was in control and, therefore, the sample data was reported without further clarification.
4	The MS/MSD RPD was out of control due to matrix interference. The LCS/LCSD RPD was in control and, therefore, the sample data was reported without further clarification.
5	The PDS/PDSD associated with this batch of samples was out of control due to a matrix interference effect. The associated batch LCS/LCSD was in control and, hence, the associated sample data was reported with no further corrective action required.
A	Result is the average of all dilutions, as defined by the method.
B	Analyte was present in the associated method blank.
C	Analyte presence was not confirmed on primary column.
E	Concentration exceeds the calibration range.
H	Sample received and/or analyzed past the recommended holding time.
J	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
N	Nontarget Analyte.
ND	Parameter not detected at the indicated reporting limit.
Q	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
U	Undetected at the laboratory method detection limit.
X	% Recovery and/or RPD out-of-range.
Z	Analyte presence was not confirmed by second column or GC/MS analysis.

LABORATORIES, INC.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1427
TEL: (714) 895-5494 FAX: (714) 894-7501

CALSCIENCE

CHAIN OF CUSTODY RECORD

Date 22-July-05

Page 1 of 1

LABORATORY CLIENT: GEOSYNTEC CONSULTANTS
ADDRESS: 924 Anacapa St, Suite 4A
CITY: SANTA BARBARA STATE: CA ZIP: 93101
TEL: 805 897 3800 FAX: 805 899 8699 E-MAIL: rettinger@geosyntec.com
TURNAROUND TIME: STANDARD
☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ 5 DAYS ☐ 10 DAYS
SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY)
☐ RWQCB REPORTING FORMS ☐ COELT EDF ☐
SPECIAL INSTRUCTIONS:
TO15 - Benzene, Ethylbenzene, Toluene, Xylene, 1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene,
TO3 - TPH-G
ASTMD1946 - O_2, CO_2, CH_4, N_2

CLIENT PROJECT NAME / NUMBER: HX0186
PROJECT CONTACT: Robbie Ettinger
SAMPLER(S): (SIGNATURE) Grant Scholes
COELT LOG CODE: ☐☐☐☐
P.O. NO.:
LAB USE ONLY: 07-1353
COOLER RECEIPT TEMP = °C

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	FIELD POINT NAME (FOR COELT EDF)	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH (G)	TPH (D) or	BTEX / MTBE (8260B) or	OXYGENATES (8260B)	VOCs (8260B)	5035 ENCORE PREP	SVOCs (8270C)	PEST (8081A)	PCBs (8082)	CAC, T22 METALS (6010B) / 747	PNAs (8310) or (8270C)	VOCs (TO-14A) or (TO-15)	TPH(G) (TO-3M)	TO15	TO3	ASTMD 1946
	SSP-01		22-July 05	1317	SOIL GAS	1														X	X	X
	SSP-02																					
	SSP-03			1155	SOIL GAS	1														X	X	X
	SSP-04			1035	SOIL GAS	1														X	X	X
	SSP-0X			-	SOIL GAS	1														X	X	X
	AA01			1500	AIR	1														X	X	X
	~~DUP~~			-																		

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature) Fed EX	Received for Laboratory by: (Signature)	Date: 7/25/05	Time: 10:00

DISTRIBUTION: White with final report, Green to file, Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

10/20/04 Revision

Q&Q Graphic 714-898-9702

PAGE 02 GEOSYNTEC 18058998689 07/22/2005 11:29

Calscience Environmental Laboratories, Inc.

WORK ORDER #: 05 - 07 - 1353

Cooler 0 **of** 0

SAMPLE RECEIPT FORM

CLIENT: GeoSyntec **DATE:** 7/25/05

TEMPERATURE – SAMPLES RECEIVED BY:

CALSCIENCE COURIER:

_____ Chilled, cooler with temperature blank provided.
_____ Chilled, cooler without temperature blank.
_____ Chilled and placed in cooler with wet ice.
_____ Ambient and placed in cooler with wet ice.
_____ Ambient temperature.
_____ °C Temperature blank.

LABORATORY (Other than Calscience Courier):

_____ °C Temperature blank.
_____ °C IR thermometer.
✓ Ambient temperature.

Initial: _____

CUSTODY SEAL INTACT:

Sample(s): _____ Cooler: _____ No (Not Intact) : _____ Not Applicable (N/A): ✓

Initial: _____

SAMPLE CONDITION:

	Yes	No	N/A
Chain-Of-Custody document(s) received with samples	✓		
Sample container label(s) consistent with custody papers	✓		
Sample container(s) intact and good condition	✓		
Correct containers for analyses requested	✓		
Proper preservation noted on sample label(s)			✓
VOA vial(s) free of headspace.			✓
Tedlar bag(s) free of condensation			✓

Initial: _____

COMMENTS:

Calscience
Environmental
Laboratories, Inc.

September 29, 2006

Robbie Ettinger
GeoSyntec Consultants
924 Anacapa Street
Suite 4A
Santa Barbara, CA 93101-2177

Subject: **Calscience Work Order No.: 06-09-1073**
Client Reference: HX0186

Dear Client:

Enclosed is an analytical report for the above-referenced project. The samples included in this report were received 9/21/2006 and analyzed in accordance with the attached chain-of-custody.

Unless otherwise noted, all analytical testing was accomplished in accordance with the guidelines established in our Quality Systems Manual, applicable standard operating procedures, and other related documentation. The original report of subcontracted analysis, if any, is provided herein, and follows the standard Calscience data package. The results in this analytical report are limited to the samples tested and any reproduction thereof must be made in its entirety.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Sincerely,

Calscience Environmental
Laboratories, Inc.
Stephen Nowak
Project Manager

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	09/21/06
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	ASTM D-1946
		Units:	%v

Project: HX0186

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-01-GS	**06-09-1073-1**	**09/19/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	0.319	0.144	1.44		Oxygen + Argon	2.53	0.14	1.44	
Carbon Dioxide	13.8	0.1	1.44						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-02-GS	**06-09-1073-2**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	ND	0.151	1.51		Oxygen + Argon	5.36	0.15	1.51	
Carbon Dioxide	7.65	0.15	1.51						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-03-GS	**06-09-1073-3**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	ND	0.139	1.39		Oxygen + Argon	10.9	0.1	1.39	
Carbon Dioxide	7.83	0.14	1.39						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-04-GS	**06-09-1073-4**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	ND	0.153	1.53		Oxygen + Argon	9.63	0.15	1.53	
Carbon Dioxide	10.0	0.2	1.53						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-05-GS	**06-09-1073-5**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	ND	0.152	1.52		Oxygen + Argon	13.7	0.2	1.52	
Carbon Dioxide	3.50	0.15	1.52						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-06-GS	**06-09-1073-6**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	1.42	0.15	1.49		Oxygen + Argon	3.86	0.15	1.49	
Carbon Dioxide	10.4	0.1	1.49						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-07-GS	**06-09-1073-7**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	ND	0.137	1.37		Oxygen + Argon	4.09	0.14	1.37	
Carbon Dioxide	11.7	0.1	1.37						

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-XX-GS	**06-09-1073-8**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	1.35	0.16	1.57		Oxygen + Argon	4.26	0.16	1.57	
Carbon Dioxide	10.3	0.2	1.57						

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	09/21/06
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	ASTM D-1946
		Units:	%v

Project: HX0186

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
OA-01-GS	**06-09-1073-9**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	ND	0.143	1.43		Oxygen + Argon	21.9	0.1	1.43	
Carbon Dioxide	ND	0.143	1.43						

Method Blank	**099-03-002-153**	**N/A**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Methane	ND	0.100	1		Oxygen + Argon	ND	0.100	1	
Carbon Dioxide	ND	0.100	1		Nitrogen	ND	0.100	1	
Carbon Monoxide	ND	0.100	1						

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

ACCREDITED IN ACCORDANCE WITH nelac

GeoSyntec Consultants
924 Anacapa Street
Suite 4A
Santa Barbara, CA 93101-2177

Date Received: 09/21/06
Work Order No: 06-09-1073
Preparation: N/A
Method: EPA TO-3(M)

Project: HX0186

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-01-GS	**06-09-1073-1**	**09/19/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	870	4	1.44		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-02-GS	**06-09-1073-2**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	9.4	4.5	1.51		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-03-GS	**06-09-1073-3**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	4.2	1.39		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-04-GS	**06-09-1073-4**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	4.6	1.53		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-05-GS	**06-09-1073-5**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	4.6	1.52		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-06-GS	**06-09-1073-6**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	660	4	1.49		ppm (v/v)

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	09/21/06
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-3(M)

Project: HX0186

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-07-GS	**06-09-1073-7**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	18	4	1.37		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-XX-GS	**06-09-1073-8**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	630	5	1.57		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
OA-01-GS	**06-09-1073-9**	**09/20/06**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	4.3	1.43		ppm (v/v)

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
Method Blank	**098-01-005-661**	**N/A**	**Air**	**N/A**	**09/21/06**	**060921L01**

Parameter	Result	RL	DF	Qual	Units
TPH as Gasoline	ND	3.0	1		ppm (v/v)

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	09/21/06
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-15
		Units:	ppb (v/v)
Project: HX0186			Page 1 of 3

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-01-GS	**06-09-1073-1**	**09/19/06**	**Air**	**N/A**	**09/23/06**	**060923L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	830	29	57.6		Toluene	ND	5.8	11.5	
Ethylbenzene	ND	5.8	11.5		1,3,5-Trimethylbenzene	ND	5.8	11.5	
o-Xylene	ND	5.8	11.5		1,2,4-Trimethylbenzene	ND	12	11.5	
p/m-Xylene	39	12	11.5						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	237	57-129	2	1,2-Dichloroethane-d4	122	47-137	
Toluene-d8	40	78-156	2				

SSP-02-GS	**06-09-1073-2**	**09/20/06**	**Air**	**N/A**	**09/22/06**	**060922L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.76	1.51		Toluene	ND	0.76	1.51	
Ethylbenzene	ND	0.76	1.51		1,3,5-Trimethylbenzene	ND	0.76	1.51	
o-Xylene	ND	0.76	1.51		1,2,4-Trimethylbenzene	ND	1.5	1.51	
p/m-Xylene	ND	1.5	1.51						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	95	57-129		1,2-Dichloroethane-d4	130	47-137	
Toluene-d8	108	78-156					

SSP-03-GS	**06-09-1073-3**	**09/20/06**	**Air**	**N/A**	**09/23/06**	**060922L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.70	1.39		Toluene	1.1	0.7	1.39	
Ethylbenzene	ND	0.70	1.39		1,3,5-Trimethylbenzene	0.81	0.70	1.39	
o-Xylene	ND	0.70	1.39		1,2,4-Trimethylbenzene	3.4	1.4	1.39	
p/m-Xylene	1.7	1.4	1.39						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	108	57-129		1,2-Dichloroethane-d4	124	47-137	
Toluene-d8	113	78-156					

SSP-04-GS	**06-09-1073-4**	**09/20/06**	**Air**	**N/A**	**09/23/06**	**060922L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.77	1.53		Toluene	0.87	0.77	1.53	
Ethylbenzene	ND	0.77	1.53		1,3,5-Trimethylbenzene	ND	0.77	1.53	
o-Xylene	ND	0.77	1.53		1,2,4-Trimethylbenzene	ND	1.5	1.53	
p/m-Xylene	ND	1.5	1.53						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	109	57-129		1,2-Dichloroethane-d4	110	47-137	
Toluene-d8	103	78-156					

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	09/21/06
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-15
		Units:	ppb (v/v)
Project: HX0186			Page 2 of 3

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
SSP-05-GS	**06-09-1073-5**	**09/20/06**	**Air**	**N/A**	**09/23/06**	**060922L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.76	1.52		Toluene	7.3	0.8	1.52	
Ethylbenzene	ND	0.76	1.52		1,3,5-Trimethylbenzene	5.3	0.8	1.52	
o-Xylene	3.0	0.8	1.52		1,2,4-Trimethylbenzene	11	2	1.52	
p/m-Xylene	5.5	1.5	1.52						
Surrogates:	REC (%)	Control Limits		Qual	Surrogates:	REC (%)	Control Limits		Qual
1,4-Bromofluorobenzene	110	57-129			1,2-Dichloroethane-d4	111	47-137		
Toluene-d8	101	78-156							

SSP-06-GS	**06-09-1073-6**	**09/20/06**	**Air**	**N/A**	**09/25/06**	**060925L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	2300	150	298		Toluene	ND	30	59.6	
Ethylbenzene	ND	30	59.6		1,3,5-Trimethylbenzene	ND	30	59.6	
o-Xylene	ND	30	59.6		1,2,4-Trimethylbenzene	300	60	59.6	
p/m-Xylene	ND	60	59.6						
Surrogates:	REC (%)	Control Limits		Qual	Surrogates:	REC (%)	Control Limits		Qual
1,4-Bromofluorobenzene	129	57-129			1,2-Dichloroethane-d4	102	47-137		
Toluene-d8	108	78-156							

SSP-07-GS	**06-09-1073-7**	**09/20/06**	**Air**	**N/A**	**09/23/06**	**060923L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	17	1	1.37		Toluene	1.6	0.7	1.37	
Ethylbenzene	1.0	0.7	1.37		1,3,5-Trimethylbenzene	ND	0.69	1.37	
o-Xylene	0.95	0.69	1.37		1,2,4-Trimethylbenzene	ND	1.4	1.37	
p/m-Xylene	2.3	1.4	1.37						
Surrogates:	REC (%)	Control Limits		Qual	Surrogates:	REC (%)	Control Limits		Qual
1,4-Bromofluorobenzene	100	57-129			1,2-Dichloroethane-d4	123	47-137		
Toluene-d8	101	78-156							

SSP-XX-GS	**06-09-1073-8**	**09/20/06**	**Air**	**N/A**	**09/25/06**	**060925L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	1700	140	283		Toluene	ND	31	62.8	
Ethylbenzene	ND	31	62.8		1,3,5-Trimethylbenzene	ND	31	62.8	
o-Xylene	ND	31	62.8		1,2,4-Trimethylbenzene	370	63	62.8	
p/m-Xylene	74	63	62.8						
Surrogates:	REC (%)	Control Limits		Qual	Surrogates:	REC (%)	Control Limits		Qual
1,4-Bromofluorobenzene	114	57-129			1,2-Dichloroethane-d4	102	47-137		
Toluene-d8	99	78-156							

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Analytical Report

GeoSyntec Consultants		Date Received:	09/21/06
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-15
		Units:	ppb (v/v)
Project: HX0186			Page 3 of 3

Client Sample Number	Lab Sample Number	Date Collected	Matrix	Date Prepared	Date Analyzed	QC Batch ID
OA-01-GS	**06-09-1073-9**	**09/20/06**	**Air**	**N/A**	**09/23/06**	**060922L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.72	1.43		Toluene	ND	0.72	1.43	
Ethylbenzene	ND	0.72	1.43		1,3,5-Trimethylbenzene	ND	0.72	1.43	
o-Xylene	ND	0.72	1.43		1,2,4-Trimethylbenzene	ND	1.4	1.43	
p/m-Xylene	ND	1.4	1.43						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	105	57-129		1,2-Dichloroethane-d4	108	47-137	
Toluene-d8	100	78-156					

Method Blank	**095-01-021-4,205**	**N/A**	**Air**	**N/A**	**09/22/06**	**060922L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.50	1		Toluene	ND	0.50	1	
Ethylbenzene	ND	0.50	1		1,3,5-Trimethylbenzene	ND	0.50	1	
o-Xylene	ND	0.50	1		1,2,4-Trimethylbenzene	ND	1.0	1	
p/m-Xylene	ND	1.0	1						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	106	57-129		1,2-Dichloroethane-d4	134	47-137	
Toluene-d8	106	78-156					

Method Blank	**095-01-021-4,206**	**N/A**	**Air**	**N/A**	**09/23/06**	**060923L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.50	1		Toluene	ND	0.50	1	
Ethylbenzene	ND	0.50	1		1,3,5-Trimethylbenzene	ND	0.50	1	
o-Xylene	ND	0.50	1		1,2,4-Trimethylbenzene	ND	1.0	1	
p/m-Xylene	ND	1.0	1						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	106	57-129		1,2-Dichloroethane-d4	132	47-137	
Toluene-d8	105	78-156					

Method Blank	**095-01-021-4,207**	**N/A**	**Air**	**N/A**	**09/25/06**	**060925L01**

Parameter	Result	RL	DF	Qual	Parameter	Result	RL	DF	Qual
Benzene	ND	0.50	1		Toluene	ND	0.50	1	
Ethylbenzene	ND	0.50	1		1,3,5-Trimethylbenzene	ND	0.50	1	
o-Xylene	ND	0.50	1		1,2,4-Trimethylbenzene	ND	1.0	1	
p/m-Xylene	ND	1.0	1						

Surrogates:	REC (%)	Control Limits	Qual	Surrogates:	REC (%)	Control Limits	Qual
1,4-Bromofluorobenzene	94	57-129		1,2-Dichloroethane-d4	108	47-137	
Toluene-d8	89	78-156					

RL - Reporting Limit , DF - Dilution Factor , Qual - Qualifiers

Calscience Environmental Laboratories, Inc.

Quality Control - Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

GeoSyntec Consultants		Date Received:	09/21/06
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-3(M)

Project: HX0186

Quality Control Sample ID	Matrix	Instrument	Date Prepared:	Date Analyzed:	Duplicate Batch Number
06-09-1051-1	**Air**	**GC 13**	**N/A**	**09/21/06**	**060921D01**

Parameter	Sample Conc	DUP Conc	RPD	RPD CL	Qualifiers
TPH as Gasoline	17	16	0	0-20	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

GeoSyntec Consultants		Date Received:	N/A
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	ASTM D-1946

Project: HX0186

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
099-03-002-153	**Air**	**GC 34**	**N/A**	**09/21/06**	**060921L01**

Parameter	LCS Conc	LCSD Conc	RPD	RPD CL	Qualifiers
Carbon Dioxide	4.90	4.87	1	0-30	
Oxygen + Argon	19.7	19.6	1	0-30	
Nitrogen	73.7	73.4	0	0-30	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

GeoSyntec Consultants		Date Received:	N/A
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-15

Project: HX0186

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
095-01-021-4,205	**Air**	**GC/MS II**	**N/A**	**09/22/06**	**060922L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Benzene	94	95	60-156	1	0-40	
Carbon Tetrachloride	115	119	64-154	3	0-32	
1,2-Dibromoethane	108	102	54-144	5	0-36	
1,2-Dichlorobenzene	105	109	34-160	4	0-47	
1,2-Dichloroethane	124	130	69-153	5	0-30	
1,2-Dichloropropane	95	99	67-157	4	0-35	
1,4-Dichlorobenzene	107	111	36-156	3	0-47	
c-1,3-Dichloropropene	89	94	61-157	6	0-35	
Ethylbenzene	111	113	52-154	1	0-38	
o-Xylene	123	127	52-148	3	0-38	
p/m-Xylene	111	113	42-156	2	0-41	
Tetrachloroethene	102	95	56-152	7	0-40	
Toluene	119	107	56-146	11	0-43	
Trichloroethene	102	102	63-159	0	0-34	
1,1,2-Trichloroethane	95	108	65-149	13	0-37	
Vinyl Chloride	126	122	45-177	3	0-36	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

ACCREDITED IN ACCORDANCE WITH nelac

GeoSyntec Consultants		Date Received:	N/A
924 Anacapa Street		Work Order No:	06-09-1073
Suite 4A		Preparation:	N/A
Santa Barbara, CA 93101-2177		Method:	EPA TO-15

Project: HX0186

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
095-01-021-4,206	**Air**	**GC/MS II**	**N/A**	**09/23/06**	**060923L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Benzene	118	94	60-156	23	0-40	
Carbon Tetrachloride	150	119	64-154	23	0-32	
1,2-Dibromoethane	118	100	54-144	17	0-36	
1,2-Dichlorobenzene	122	102	34-160	18	0-47	
1,2-Dichloroethane	122	118	69-153	3	0-30	
1,2-Dichloropropane	120	93	67-157	25	0-35	
1,4-Dichlorobenzene	126	105	36-156	18	0-47	
c-1,3-Dichloropropene	119	92	61-157	26	0-35	
Ethylbenzene	129	109	52-154	17	0-38	
o-Xylene	141	119	52-148	17	0-38	
p/m-Xylene	126	107	42-156	16	0-41	
Tetrachloroethene	111	94	56-152	16	0-40	
Toluene	119	103	56-146	15	0-43	
Trichloroethene	130	103	63-159	23	0-34	
1,1,2-Trichloroethane	137	106	65-149	26	0-37	
Vinyl Chloride	115	110	45-177	4	0-36	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Quality Control - LCS/LCS Duplicate

GeoSyntec Consultants
924 Anacapa Street
Suite 4A
Santa Barbara, CA 93101-2177

Date Received: N/A
Work Order No: 06-09-1073
Preparation: N/A
Method: EPA TO-15

Project: HX0186

Quality Control Sample ID	Matrix	Instrument	Date Prepared	Date Analyzed	LCS/LCSD Batch Number
095-01-021-4,207	**Air**	**GC/MS II**	**N/A**	**09/25/06**	**060925L01**

Parameter	LCS %REC	LCSD %REC	%REC CL	RPD	RPD CL	Qualifiers
Benzene	85	89	60-156	5	0-40	
Carbon Tetrachloride	93	97	64-154	4	0-32	
1,2-Dibromoethane	93	102	54-144	10	0-36	
1,2-Dichlorobenzene	101	112	34-160	11	0-47	
1,2-Dichloroethane	98	98	69-153	1	0-30	
1,2-Dichloropropane	89	93	67-157	4	0-35	
1,4-Dichlorobenzene	102	114	36-156	10	0-47	
c-1,3-Dichloropropene	85	89	61-157	5	0-35	
Ethylbenzene	97	108	52-154	10	0-38	
o-Xylene	98	110	52-148	11	0-38	
p/m-Xylene	92	102	42-156	11	0-41	
Tetrachloroethene	94	102	56-152	9	0-40	
Toluene	95	104	56-146	9	0-43	
Trichloroethene	91	95	63-159	4	0-34	
1,1,2-Trichloroethane	99	104	65-149	5	0-37	
Vinyl Chloride	100	103	45-177	3	0-36	

RPD - Relative Percent Difference , CL - Control Limit

Calscience Environmental Laboratories, Inc.

Glossary of Terms and Qualifiers

Work Order Number: 06-09-1073

Qualifier	Definition
*	See applicable analysis comment.
1	Surrogate compound recovery was out of control due to a required sample dilution, therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike or Matrix Spike Duplicate compound was out of control due to matrix interference. The associated LCS and/or LCSD was in control and, therefore, the sample data was reported without further clarification.
4	The MS/MSD RPD was out of control due to matrix interference. The LCS/LCSD RPD was in control and, therefore, the sample data was reported without further clarification.
5	The PDS/PDSD associated with this batch of samples was out of control due to a matrix interference effect. The associated batch LCS/LCSD was in control and, hence, the associated sample data was reported with no further corrective action required.
A	Result is the average of all dilutions, as defined by the method.
B	Analyte was present in the associated method blank.
C	Analyte presence was not confirmed on primary column.
E	Concentration exceeds the calibration range.
H	Sample received and/or analyzed past the recommended holding time.
J	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
N	Nontarget Analyte.
ND	Parameter not detected at the indicated reporting limit.
Q	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
U	Undetected at the laboratory method detection limit.
X	% Recovery and/or RPD out-of-range.
Z	Analyte presence was not confirmed by second column or GC/MS analysis.

CALSCIENCE ENVIRONMENTAL LABORATORIES, INC.
7440 LINCOLN WAY
GARDEN GROVE, CA 92841-1427
TEL: (714) 895-5494 • FAX: (714) 894-7501

CHAIN OF CUSTODY RECORD

Date 20 Sept 06

Page 1 of 1

LABORATORY CLIENT: Robbie Ettinger - GeoSyntec Consultants
ADDRESS: 924 Anacapa St Suite 4A
CITY: Santa Barbara STATE: CA ZIP: 93101
TEL: 805 897 3800 E-MAIL: rettinger@geosyntec.com
TURNAROUND TIME: ☐ SAME DAY ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ 5 DAYS ☒ 10 DAYS
SPECIAL REQUIREMENTS (ADDITIONAL COSTS MAY APPLY): ☐ RWQCB REPORTING FORMS ☐ COELT EDF ☐ ____
SPECIAL INSTRUCTIONS:
VOCs TO INCLUDE ONLY: Benzene, toluene, xylene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene
ASTM D-1946 - O2, CO2, CH4 only.

CLIENT PROJECT NAME / NUMBER: HX0186
PROJECT CONTACT: Robbie Ettinger
SAMPLER(S): (PRINT) Grant Scholes
COELT LOG CODE: ☐☐☐☐
P.O. NO.: HX0186
LAB USE ONLY: 09-10773
COOLER RECEIPT TEMP = ____ °C

REQUESTED ANALYSES

LAB USE ONLY	SAMPLE ID	FIELD POINT NAME (FOR COELT EDF)	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH (G)	TPH (D) or ____	BTEX / MTBE (8260B) or ____	OXYGENATES (8260B)	VOCs (8260B)	5035 ENCORE PREP	SVOCs (8270C)	PEST (8081A)	PCBs (8082)	CAC, T22 METALS (6010B) / 747 ____	PNAs (8310) or (8270C)	VOCs (TO-14A) or (TO-15)	TPH(G) (TO-3M)	FG's BY ASTM D-1946
1	SSP-01-GS		19Sep06	1730	VAPOR	1												X	X	X
2	SSP-02-GS		20Sep06	932		1														
3	SSP-03-GS			1530		1														
4	SSP-04-GS			1135		1														
5	SSP-05-GS			1006		1														
6	SSP-06-GS			1250		1														
7	SSP-07-GS			1046		1														
8	SSP-XX-GS			—		1														
9	SS OA-01-GS			1600		1														

Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date: 9.21.06	Time: 1000
Relinquished by: (Signature)	Received by: (Signature/Affiliation)	Date:	Time:

DISTRIBUTION: White with final report, Green and Yellow to Client.
Please note that pages 1 and 2 of 2 of our T/Cs are printed on the reverse side of the Green and Yellow copies respectively.

05/10/06 Revision

Q&Q Graphic 714-898-9702

Calscience Environmental Laboratories, Inc.

WORK ORDER #: 06 - 09 - 1073

Cooler 1 of 1

SAMPLE RECEIPT FORM

CLIENT: GeoSyntec **DATE:** 9.21.06

TEMPERATURE – SAMPLES RECEIVED BY:

CALSCIENCE COURIER:

_____ Chilled, cooler with temperature blank provided.
_____ Chilled, cooler without temperature blank.
_____ Chilled and placed in cooler with wet ice.
_____ Ambient and placed in cooler with wet ice.
_____ Ambient temperature.

_____ °C Temperature blank.

LABORATORY (Other than Calscience Courier):

_____ °C Temperature blank.
_____ °C IR thermometer.
✓ Ambient temperature.

Initial: SF

CUSTODY SEAL INTACT:

Sample(s): _____ Cooler: _____ No (Not Intact) : _____ Not Applicable (N/A): ✓

Initial: SF

SAMPLE CONDITION:

	Yes	No	N/A
Chain-Of-Custody document(s) received with samples	✓		
Sampler's name indicated on COC	✓		
Sample container label(s) consistent with custody papers	✓		
Sample container(s) intact and good condition	✓		
Correct containers and volume for analyses requested	✓		
Proper preservation noted on sample label(s)			✓
VOA vial(s) free of headspace.			✓
Tedlar bag(s) free of condensation			✓

Initial: SF

COMMENTS:

Geosyntec consultants

APPENDIX C

BAROMETRIC AND DIFFERENTIAL PRESSURE DATA

Figure C1:
Barometric Data Collected Inside the Site Building
Astoria Area-Wide Petroleum Site

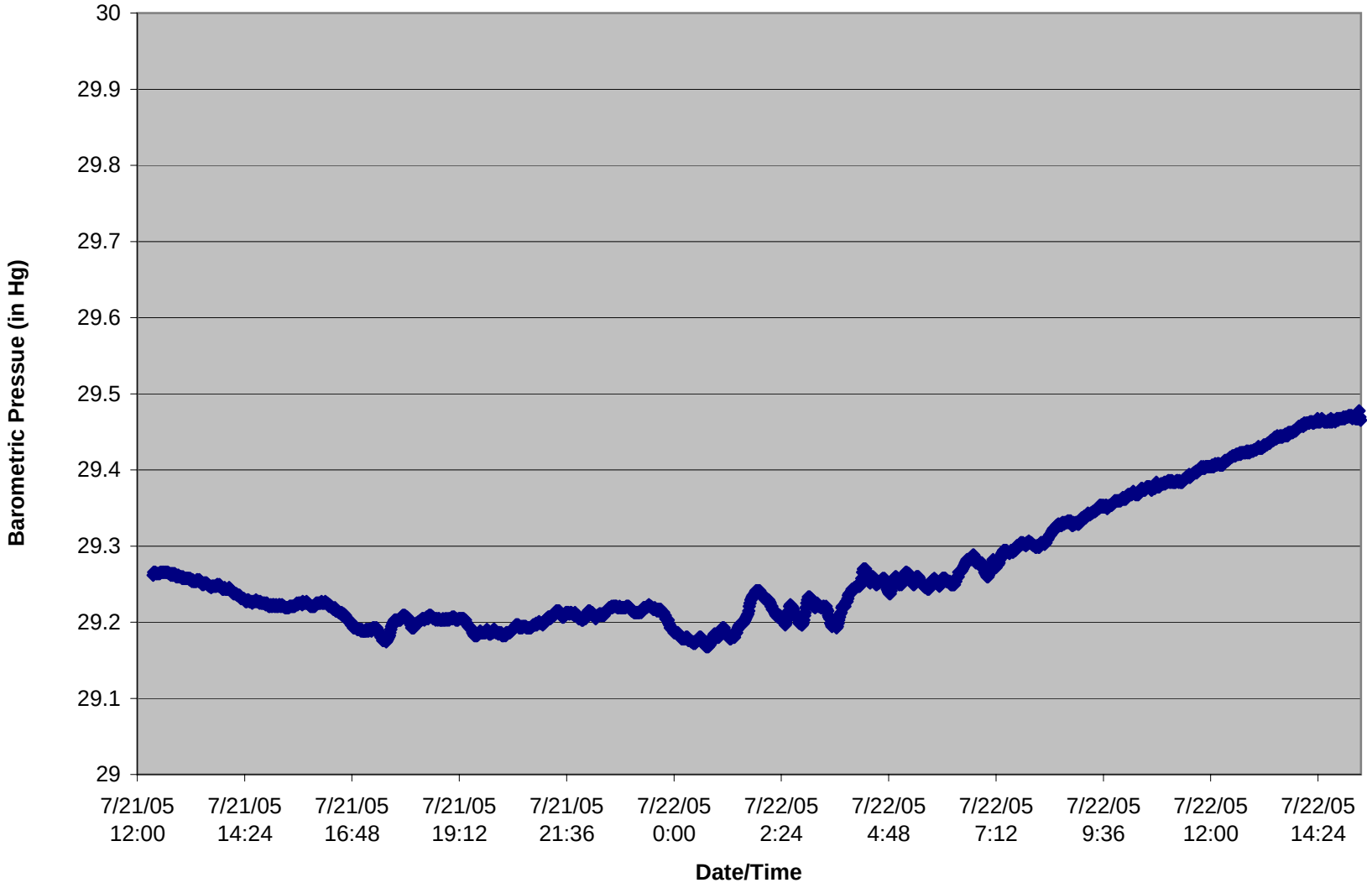


FIGURE C2:
DIFFERENTIAL PRESSURE DATA FOR SSP-03
Astoria Area-Wide Petroleum Site
July 2005

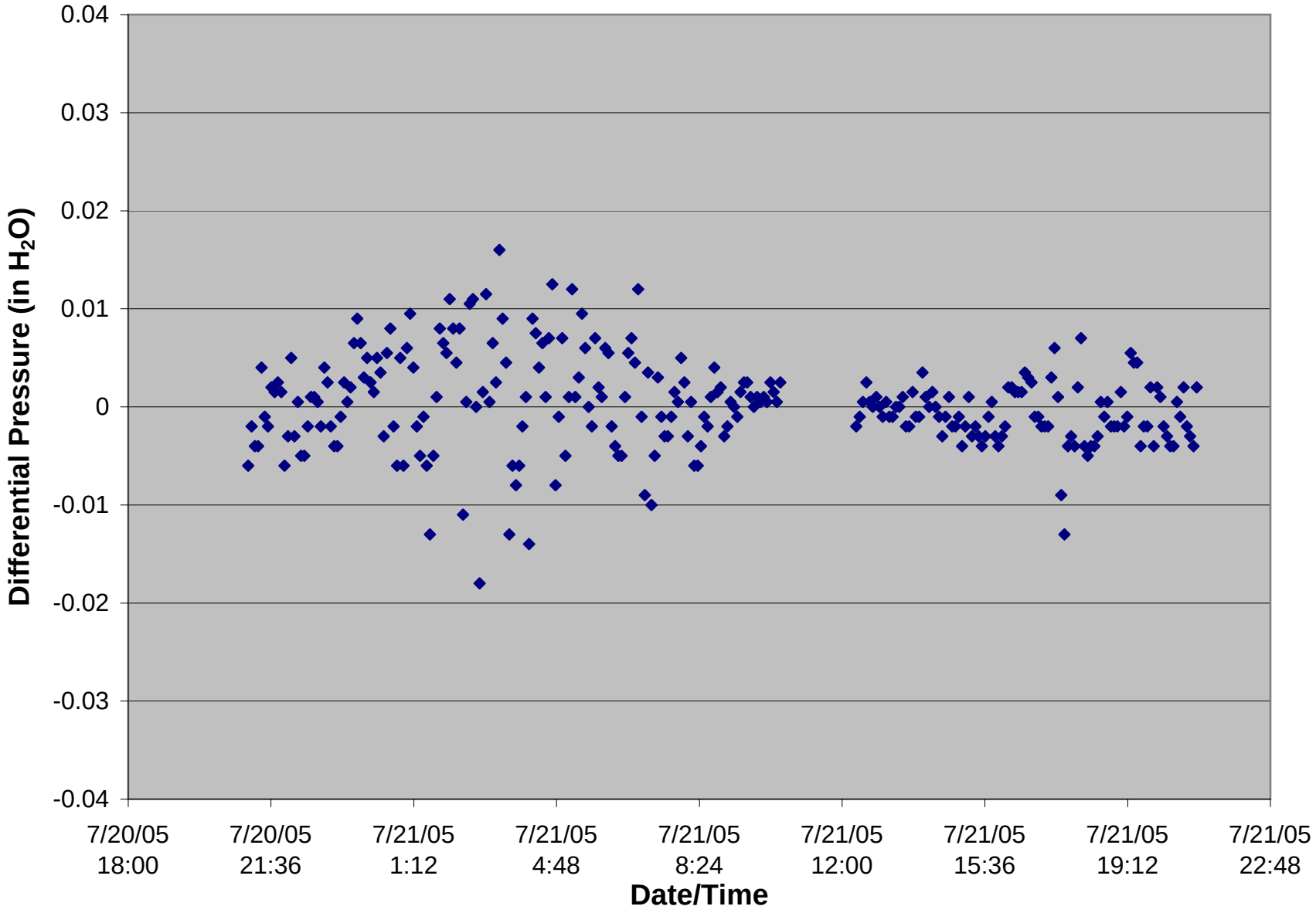
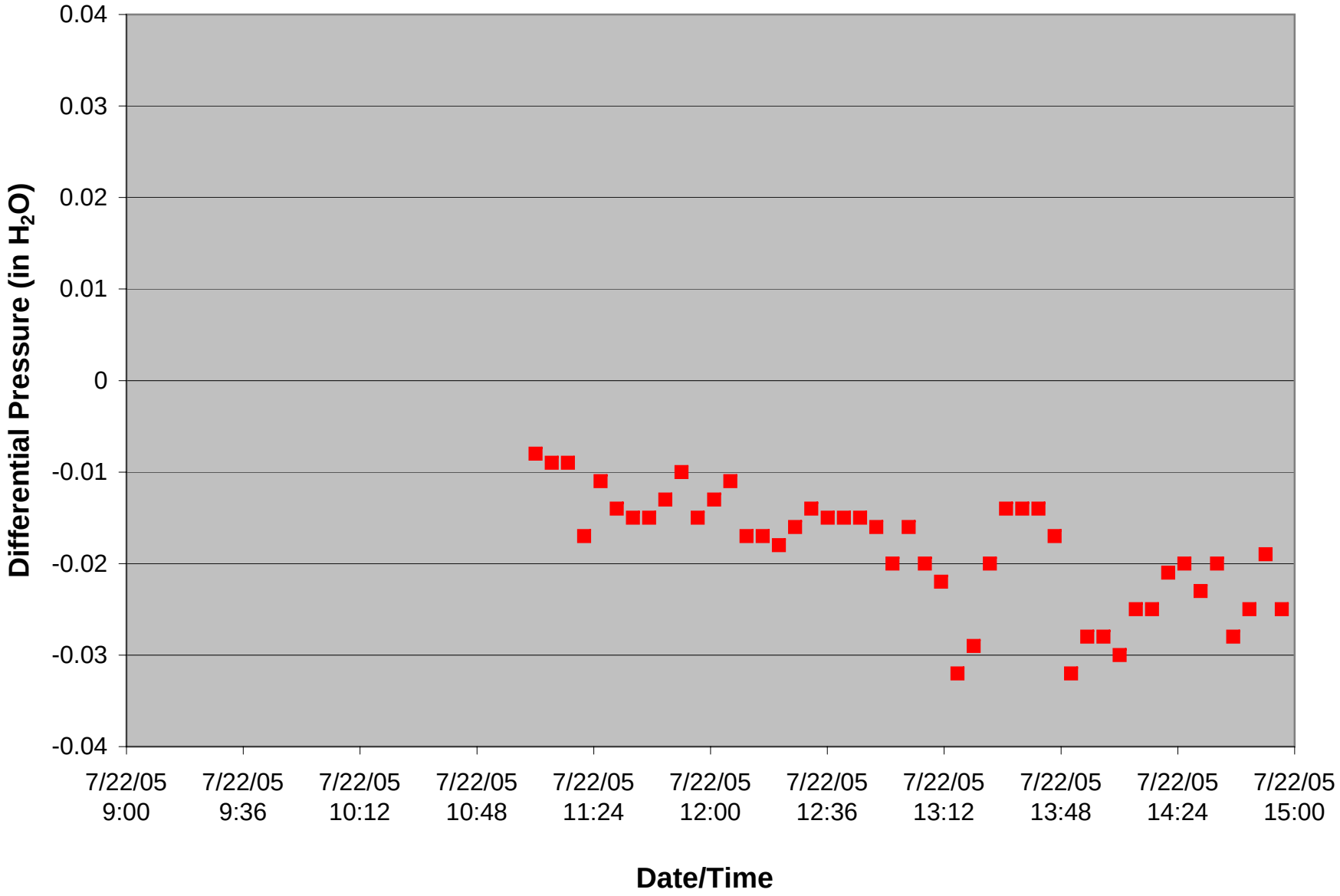


FIGURE C3:
DIFFERENTIAL PRESSURE DATA FOR SSP-04
Astoria Area-Wide Petroleum Site
July 2005



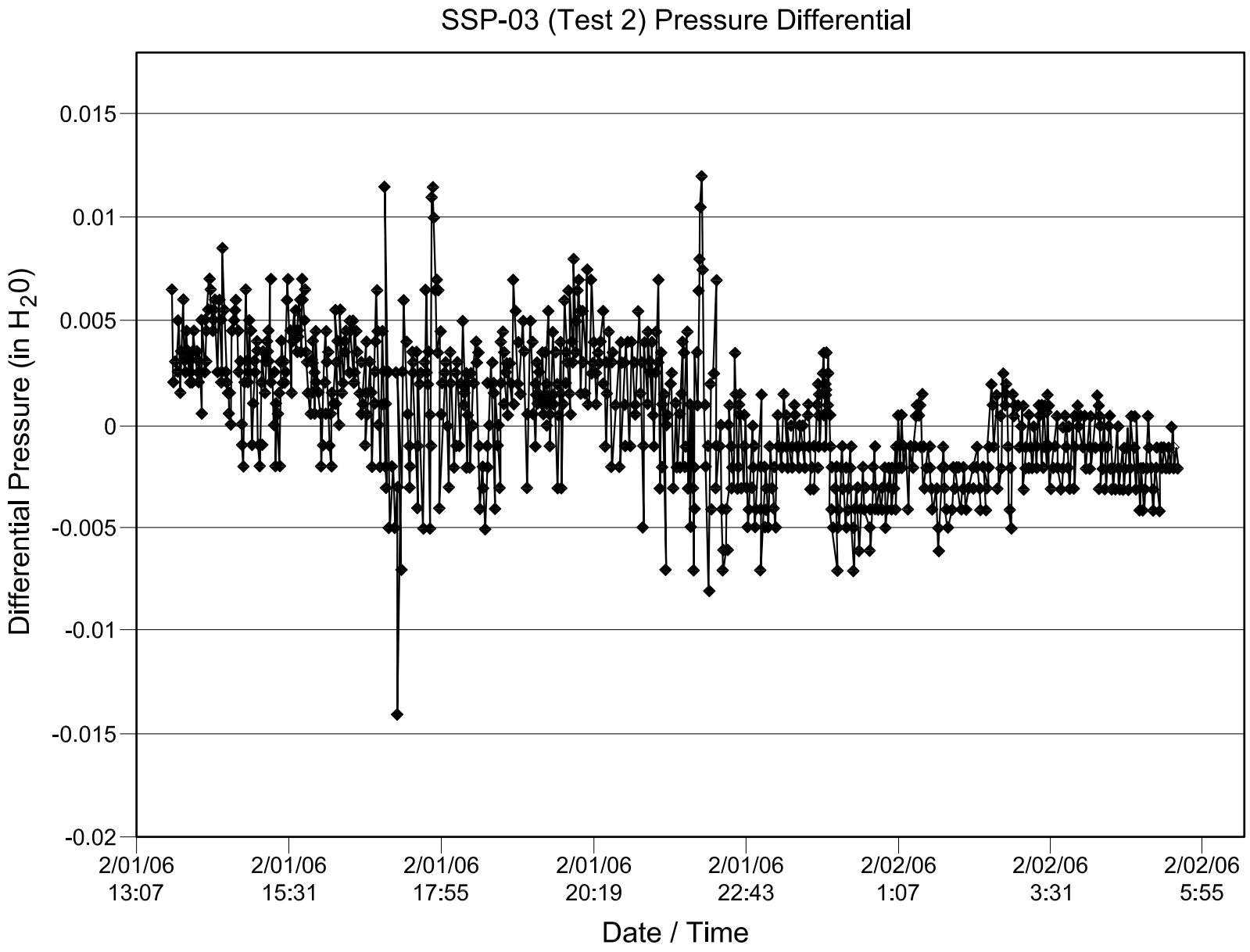


FIGURE 7-2

DIFFERENTIAL PRESSURE GRAPH
Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

EnviroLogic Resources, Inc.
ENVIRONMENTAL • WATER RESOURCES SCIENTISTS

G:\0900\992\101\Cad\10077.009\June2007\092101_10077_009_F7-2 16:34 09/04/2007 SS

APPENDIX I

Appendix I contains the Kennedy/Jenks Consultants report dated October 16, 2006 presenting the Level III Ecological Risk Assessment.

EnviroLogic Resources, Inc.
Consulting Environmental & Water Resources Scientists

October 24, 2006
10077.012

Oregon Department of Environmental Quality
Northwest Region
2020 SW Fourth Avenue
Suite 400
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
Project Manager

cc: Distribution list attached

ASTORIA AREA-WIDE PETROLEUM SITE
Distribution List

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1 Information Repository

Kennedy/Jenks Consultants

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503-295-4911
503-295-4901 (Fax)

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

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

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 ± 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

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

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

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.

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Tables

Table 1: Sampling Station Coordinates

Station ID	Latitude	Longitude	Approximate Depth to Mudline (ft)	Approximate Tidal Height (ft)	Approximate Depth to Mudline (ft) (ft)[(a)]
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)[a]	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[b]			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)[a]	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[b]			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)[a]	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 [b]			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 Water Depth (ft)[(a)]	Conventional Sediment Parameters						Grain Size	
			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)[a]	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 [b]						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)[a]	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	**40**	20	350 U	250 U	420 U	**540** JD	350 U	**600** JD
SD-102	1/26/2006	-4.1	0-10	**160**	**60**	520 U	370 U	630 U	**620** JD	**700** JD	**1,540** JD
SD-103	1/26/2006	1.4	0-10	7.0 J	8.3 J	**15**	**10** J	**45**	**110**	**480**	**675** 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 [b]				35	20	6	7	21	86	47	312

Table 4: Sediment Chemistry and Grain Size Results

Sample ID	Sample Date	Approximate Water Depth (feet)[a]	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 [b]				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)[a]	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 [b]				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)[a]	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	**100**
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 [b]				6	6	58	63	1,300	61

Table 4: Sediment Chemistry and Grain Size Results

				Misc. Extractable Compounds (µg/kg)				(µg/L)	Ionizable Organic Compounds (µg/kg)						
Sample ID	Sample Date	Approximate Water Depth (feet)[a]	Sample Depth (cm)	Dibenzo-furan	Hexachloro-butadiene	N-nitroso-diphenylamine	Total PCBs [d]	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	**46**	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	**58**	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	**135**	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	**23** 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 [b]				110	1	28	22	0.15 [c]	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 = miligrams 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[(a)] ($M_T - M_R > 30\%$) (Pass/Fail)	Two-Hit Criteria[(b)] (significant difference from reference in any two tests) (Yes/No)	Bulk Interstitial Salinity (ppt)
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 x 50%	One-Hit Criteria[(a)] ($G_T < G_R$ x 50%) (Pass/Fail)	Two-Hit Criteria[(b)] (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_T) (%)	Significantly Different from REF-EBB at α = 0.10?	REF-EBB Reference Mean NCMA (N_R) (%)	N_R + 30%	One-Hit Criteria[(a)] ($N_T > N_R + 30\%$) (Pass/Fail)	Two-Hit Criteria[(b)] (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	--	--	--	--	--

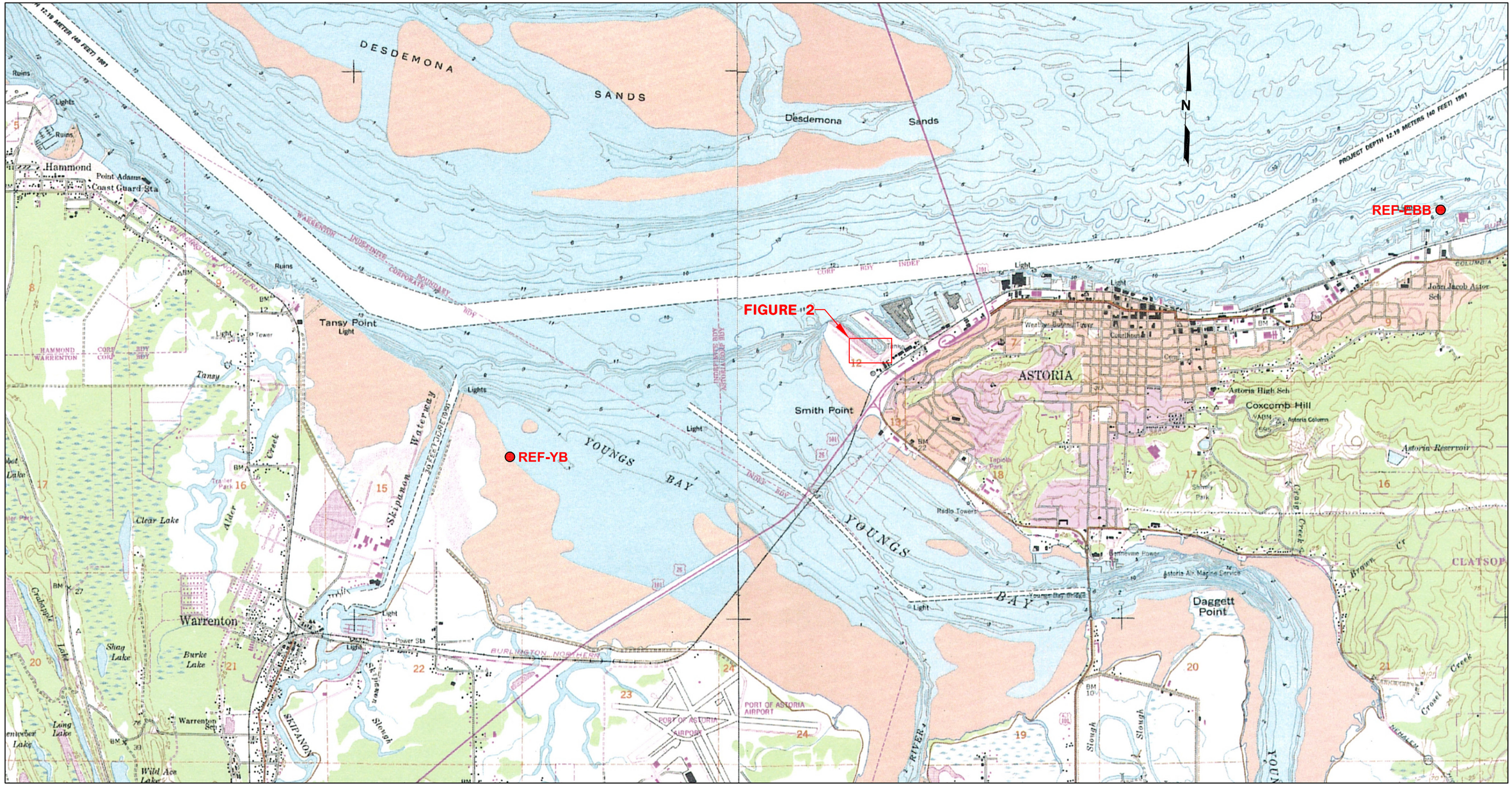
Notes:

(a) One hit required to fail bioassay.

(b) Two hits required to fail bioassay.

SW - seawater.

Figures



LEGEND :

REF-EBB ● REFERENCE SEDIMENT SAMPLE

1,500 0 3,000

Approximate Scale in Feet

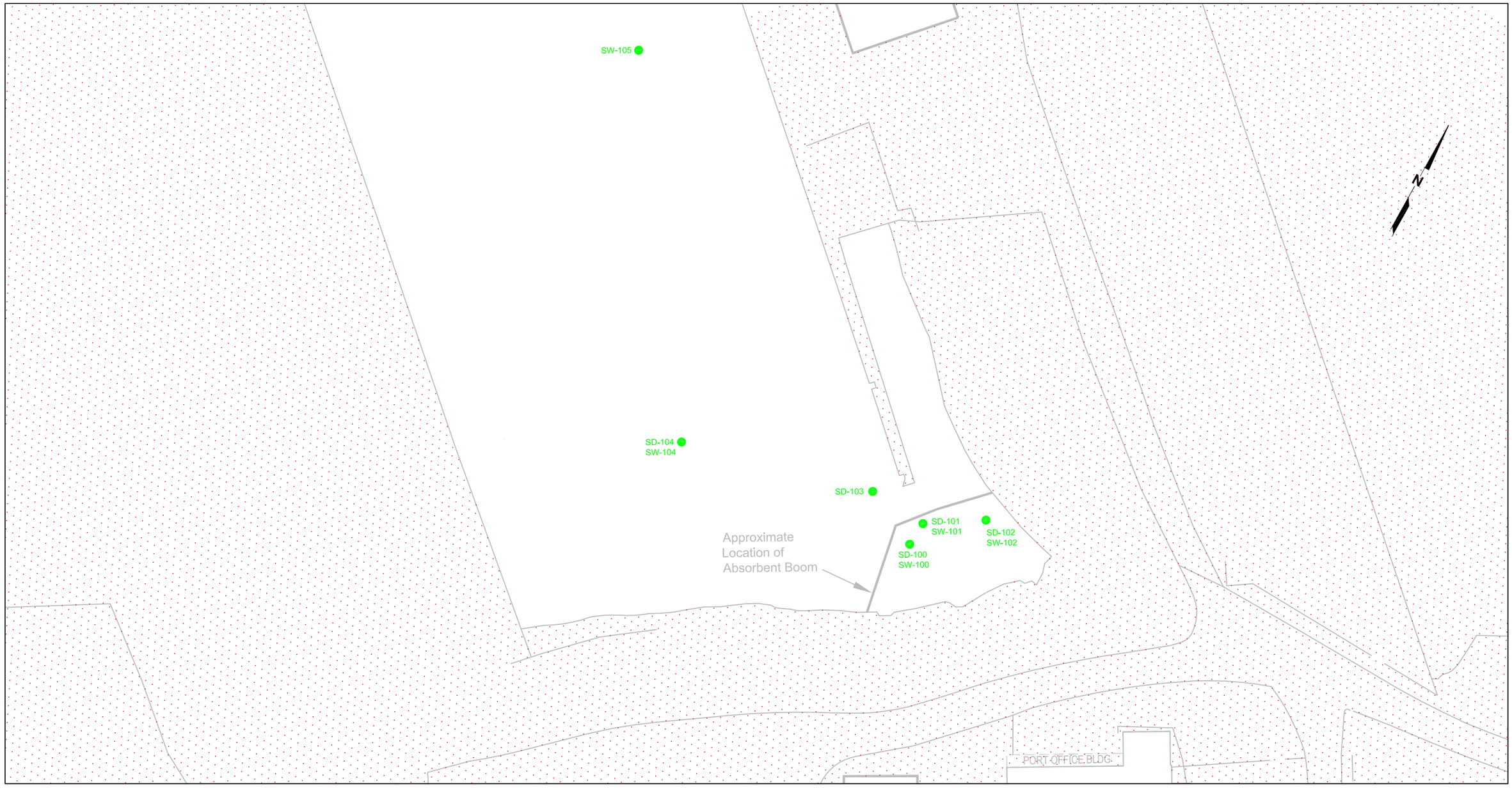
Kennedy/Jenks Consultants

ECOLOGICAL RISK ASSESSMENT
ASTORIA, OREGON

REFERENCE SEDIMENT STATIONS

Figure 1
K/J 0592004.00

Q:\Projects\05pro\0592004.00_Astoria Area-Wide PRP Group\09 - ERA Report\Figures\0592004_00 - FIGURE 1.dwg Sep 20, 2006 - 9:29am



LEGEND :

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

40 0 80
Scale in Feet

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

Q:\Projects\05proj\0592004.00_Astoria Area-Wide PRP Group\09 - ERA Report\Figures\0592004_00 - FIGURE 2.dwg Sep 20, 2006 - 9:32am

Appendix A

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

Sediment Sampling Data Sheets

Kennedy/Jenks Consultants

SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: Astoria Area-Wide	K/J #: 0597004.00
K/J PERSONNEL: TP + CR	DATE: 1/26/06
SUBCONTRACTOR: NWDC	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'	

RUN #	TIME	SAMPLE DEPTH	OBSERVATIONS (grain size, color, odor, sheen, organisms, shells, debris)	ACCEPT?
1	1145	10	greyish blackish silt, petroleum odor, sheen present, woody debris, organic matter	Y

NOTES AND ANALYSES:

Kennedy/Jenks Consultants

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 (grain size, color, odor, sheen, organisms, shells, debris)	ACCEPT?
1	1220	10	greyish black silt, petroleum odor, sheen, woody debris	Y

NOTES AND ANALYSES:

Kennedy/Jenks Consultants

SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: Astoria Area-Wide	K/J #: 0592004.00
K/J PERSONNEL: TP + CR	DATE:
SUBCONTRACTOR: NWUC	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 (grain size, color, odor, sheen, organisms, shells, debris)	ACCEPT?
1	1300	10	greyish sandy silt, petroleum odor, slight sheen, lots of woody debris	Y

NOTES AND ANALYSES:

Kennedy/Jenks Consultants

SEDIMENT SAMPLING DATA SHEET

PROJECT NAME: Astoria Area - Wide	K/J #: 0592004.00
K/J PERSONNEL: TP + CR	DATE: 11/26/06
SUBCONTRACTOR: NWVC	WEATHER:
SAMPLING METHOD: Diver Core	
SAMPLE ID: SD-103	LATITUDE:
WATER DEPTH: 6'	LONGITUDE:
TIDAL HEIGHT: ~ 4.6'	
CORRECTED DEPTH: ~ 1.4'	

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

NOTES AND ANALYSES:

Kennedy/Jenks Consultants

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-104	LATITUDE:
WATER DEPTH: 10'	LONGITUDE:
TIDAL HEIGHT: ~3.7'	
CORRECTED DEPTH: ~6.3'	

RUN #	TIME	SAMPLE DEPTH	OBSERVATIONS (grain size, color, odor, sheen, organisms, shells, debris)	ACCEPT?
1	1400	10	Brownish gray silt, no odor, no sheen, several worms	Y

NOTES AND ANALYSES:

Kennedy/Jenks Consultants

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-ERB	LATITUDE:
WATER DEPTH: 16'	LONGITUDE:
TIDAL HEIGHT: ~0.2'	
CORRECTED DEPTH: ~15.8'	

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

NOTES AND ANALYSES: 70% fines by wet sieve

Kennedy/Jenks Consultants

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-YB	LATITUDE:
WATER DEPTH: 2.5'	LONGITUDE:
TIDAL HEIGHT: ~1.8'	
CORRECTED DEPTH: ~0.7'	

RUN #	TIME	SAMPLE DEPTH	OBSERVATIONS (grain size, color, odor, sheen, organisms, shells, debris)	ACCEPT?
1	1510	10	Brownish grey silty clay, some small shells, no debris no odor, no sheen	Y

NOTES AND ANALYSES: 68% fines by wet sieve

Appendix C

Laboratory Chemical Analytical Reports

2655 Park Center Drive, Suite A Simi Valley, California 96065 (805) 526-7161 (805) 526-7270 fax

Columbia Analytical Services INC.
An Employee - Owned Company

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

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.	**Service Request No.:**	K0600765
Project:	Astoria Area-Wide/592004.00	**Date Received:**	01/28/06
Sample Matrix:	Water and Soil		

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 Gregory Carlisle **Date** 2/21/06

Chain of Custody Documentation

Columbia Analytical Services INC.
An Employee - Owned Company

CHAIN OF CUSTODY

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222x07 • FAX (360) 636-1068

SR#: 10600765

PAGE 1 OF 2 COC #

PROJECT NAME: Astoria Area-Wide
PROJECT NUMBER: 0592004.00
PROJECT MANAGER: Taku Fuji
COMPANY/ADDRESS: Kennedy/Jenks Consultants
200 SW Market St., Suite 500
CITY/STATE/ZIP: Portland, OR 97201
E-MAIL ADDRESS: takufuji@kennedyjenks.com
PHONE # 503-295-4911 FAX 503-295-4901
SAMPLER'S SIGNATURE: P. Thomas

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL X	Volatile Organics 624 ☐ 8260 ☐	Hydrocarbons Gas ☐ 8021 ☐ BTEX ☐ Diesel ☐ (*see below) Fuel Fingerprint (FIO) ☐ Oil ☐ NW-HCID Screen ☐ Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's 8082 Aroclors X	Pesticides/Herbicides 608 ☐ 8081A ☐ Congeners ☐	Chlorophenolics 8141A ☐ 8151A ☐ Tri ☐ Tetra ☐ - 8151M PCP ☐	PAHS 8310 ☐ SIM ☐	Metals (Total or Dissolved) (See list below)	Cyanide ☐ 6020 7471A	Hex-Chrom ☐	pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle) NH_3-N COD, Total-P, TKN, TOC DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	Tri-n-butyltin	PSEP Grain Size	Total Solids	Total Sulfides, TVS	REMARKS
SD-100	1/24/06	1145	1	S	4	X				X			X			X		X	X	X	X	
SD-101		1220	2		4	X				X			X			X		X	X	X	X	
SD-102		1300	3		4	X				X			X			X		X	X	X	X	
SD-103		1330	4		4	X				X			X			X		X	X	X	X	
SD-104		1400	5		4	X				X			X			X		X	X	X	X	
REF-EBB		1630	6		4	X				X			X			X		X	X	X	X	
REF-YB		1510	7		4	X				X			X			X		X	X	X	X	

8

REPORT REQUIREMENTS

- X I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- ___ III. Data Validation Report (includes all raw data)
- ___ IV. CLP Deliverable Report
- ___ V. EDD

INVOICE INFORMATION

P.O. # 0592004.00
Bill To: Taku Fuji
KJ

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard (10-15 working days)
___ Provide FAX Results
2/13/06
Requested Report Date

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 Tl 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 Tl 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

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
P. Thomas	Frank Blau		
Signature	Signature	Signature	Signature
1/27/06 9:00	1/28/06 1030	Date/Time	Date/Time
Date/Time	Date/Time		
P. THOMAS PINIT	Frank Blau	Printed Name	Printed Name
Printed Name	Printed Name	Firm	Firm
KJ	CAS		
Firm	Firm		

RCOC #1 06/03

Columbia Analytical Services INC.
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SR#: K0600765

PAGE 2 OF 2 COC #

PROJECT NAME	Astoria Area-Wide
PROJECT NUMBER	0592004.00
PROJECT MANAGER	Taku Fuji
COMPANY/ADDRESS	Kennedy/Jenks Consultants
	200 SW Market St., Suite 500
CITY/STATE/ZIP	Portland, OR 97201
E-MAIL ADDRESS	takufuji@kennedyjenks.com
PHONE #	503-295-4911
FAX#	503-295-4901
SAMPLER'S SIGNATURE	P. Jenkins

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☒	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐ ☐ Fuel Fingerprint (FIQ) ☐ NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☒	Metals: Total or Dissolved (See list below)	Cyanide ☐	Hex-Chrom ☐	pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	REMARKS
SW-100	1/26/06	1100	8	W	4		X					X								
SW-101		1120	9		4		X					X								
SW-102		1140	10		4		X					X								
SW-104		1400	11		4		X					X								
SW-105		1435	12		4		X					X								

REPORT REQUIREMENTS

- X I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- ___ III. Data Validation Report (includes all raw data)
- ___ IV. CLP Deliverable Report
- ___ V. EDD

INVOICE INFORMATION

P.O. # 0592004.00
Bill To: Taku Fuji
KJ

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard (10-15 working days)
___ Provide FAX Results
2/13/06
Requested Report Date

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 Tl 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 Tl 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
* need 4 Trip Blanks

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
P. Jenkins			
Signature	Signature	Signature	Signature
1/27/06 9:00	1/28/06 1030	Date/Time	Date/Time
Date/Time	Date/Time		
P. THOMAS PINTI			
Printed Name	Printed Name	Printed Name	Printed Name
KJ	CAS	Firm	Firm
Firm	Firm		

RCOC #1 06/03

Columbia Analytical Services Inc. PC Greg
Cooler Receipt and Preservation Form

Project/Client Kennedy Jenks Service Request K06 0076S

Cooler received on 1/28/06 and opened on 1/28/06 by FA

1.	Were custody seals on outside of coolers?					Y N
	If yes, how many and where?	1 front 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#					
	Temperature of cooler(s) upon receipt: (°C)	4.0	3.7	5.4		
	Temperature Blank: (°C)	2.9	2.1	4.4		
	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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006
		Date Analyzed:	01/30/2006

Duplicate Sample Summary
Total Solids

Prep Method:	NONE	**Units:**	PERCENT
Analysis Method:	160.3M	**Basis:**	Wet
Test Notes:			

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/06
Sample Matrix:	Soil	**Date Received:**	01/28/06

Total Volatile Solids

Prep Method:	Method	Units:	PERCENT
Analysis Method:	PSEP	Basis:	Dry
Test Notes:			

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

1A/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 Sample Result	Average	Relative Percent Difference	Result Notes
Ammonia as Nitrogen	Method	350.3	0.5	21.4	19.6	20.5	9	

Report By: Agreer

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 Percent Recovery Acceptance Limits	Result Notes
Ammonia as Nitrogen	Method	350.3	0.5	53.2	21.4	67.1	86	75-125	

Report By: Agreer

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	Kennedy/Jenks Consultants, Incorporated	**Service Request :**	K0600765
Project Name :	Astoria Area-Wide	**Date Collected :**	NA
Project Number :	0592004.00	**Date Received :**	NA
Sample Matrix :	SOIL	**Date Prepared :**	02/03/06
		Date Analyzed :	02/03/06

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Laboratory Control Sample	Units :	mg/Kg (ppm)
Lab Code :	K0600765-LCS	Basis :	Dry
Test Notes :			

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

Report By: Agreer

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: _____ 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

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: _____ 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: _____ Date: 2/13/06

DUP/020597p
K0600765wet.ag1 - TRP 02/13/06

Page No.:

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/06
Sample Matrix:	Soil	**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 Percent Recovery Acceptance Limits	Result Notes
Sulfide, Total	Method	PSEP	450	1450	1030	2140	77	60-130	

Approved By: _____ Date: 2/13/06

MS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	NA
LCS Matrix:	Soil	**Date Received:**	NA
		Date Prepared:	02/01/06
		Date Analyzed:	02/01/06

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name:	Lab Control Sample	Units:	mg/Kg (ppm)
Lab Code:	K0600765-LCS	Basis:	Dry

Test Notes:

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: _____ Date: 2/13/06

LCS/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/06
Sample Matrix:	Soil	**Date Received:**	01/28/06

Carbon, Total Organic

Prep Method:	Method	Units:	PERCENT
Analysis Method:	PSEP	Basis:	Dry
Test Notes:			

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: _____ 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

DUP/020597p
K0600765WET.AG2 - DUP 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

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: _____ Date: 2/13/06

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/06
Sample Matrix:	Soil	**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 Percent Recovery Acceptance Limits	Result Notes
Carbon, Total Organic	Method	PSEP	0.05	9.09	2.60	11.6	99	75-125	

Approved By: _____ 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: _____ Date: 2/13/06

LCS/020597p
K0600765WET.AG2 - LCS 02/13/06

Page No.:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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: _____ Date: 2/13/06

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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: _____ Date: 2/13/06

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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: _____ Date: 2/13/06

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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: _____ Date: 2/13/06

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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: _____ Date: 2/13/06

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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: _____ Date: 2/13/06

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	1/26/2006
Sample Matrix:	Soil	**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, Incorporatec Service Request: K0600765

Project No.: 0592004.00

Project Name: Astoria Area-Wide

Sample No.	Lab Sample ID.
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
Project No.: 0592004.00
Project Name: Astoria Area-Wide
Matrix: SOIL

Service Request: K0600765
Date Collected: 01/26/06
Date Received: 01/28/06
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
Project No.: 0592004.00
Project Name: Astoria Area-Wide
Matrix: SOIL

Service Request: K0600765
Date Collected: 01/26/06
Date Received: 01/28/06
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
Project No.: 0592004.00
Project Name: Astoria Area-Wide
Matrix: SOIL

Service Request: K0600765
Date Collected: 01/26/06
Date Received: 01/28/06
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, Incorporatec
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		112 180	99
Cadmium				92.8	93.9		73.9 112	101
Chromium				172	175		135 209	102
Copper				67.0	70.2		53.8 80.2	105
Lead				67.5	69.9		53.1 81.9	104
Mercury				1.77	1.68		1.21 2.34	95
Silver				93.0	91.6		57.0 129	98
Zinc				380	410		300 460	108

Butyltins

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Butyltins (as cation)

Sample Name:	SD-100	**Units:**	ug/Kg
Lab Code:	K0600765-001	**Basis:**	Dry
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	Krone		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Butyltins (as cation)

Sample Name:	SD-101	**Units:**	ug/Kg
Lab Code:	K0600765-002	**Basis:**	Dry
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	Krone		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Butyltins (as cation)

Sample Name:	SD-102	**Units:**	ug/Kg
Lab Code:	K0600765-003	**Basis:**	Dry
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	Krone		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Butyltins (as cation)

Sample Name:	SD-103	**Units:**	ug/Kg
Lab Code:	K0600765-004	**Basis:**	Dry
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	Krone		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Butyltins (as cation)

Sample Name:	REF-EBB	**Units:**	ug/Kg
Lab Code:	K0600765-006	**Basis:**	Dry
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	Krone		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA

Butyltins (as cation)

Sample Name:	Method Blank	**Units:**	ug/Kg
Lab Code:	KWG0602239-4	**Basis:**	Dry
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	Krone		

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:

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

Sample Name	Lab Code	Sur1
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 Result	Matrix Spike Expected	Matrix Spike %Rec	REF-YBDMS KWG0602239-2 Duplicate Matrix Spike Result	Duplicate Matrix Spike Expected	Duplicate Matrix Spike %Rec	%Rec Limits	RPD	RPD Limit
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.

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

	Lab Control Sample KWG0602239-3 Lab Control Spike			
Analyte Name	**Result**	**Expected**	**%Rec**	**%Rec Limits**
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

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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3540C
Analysis Method: 8082

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	
Aroclor 1254	**25**	P	10	3.5	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	**21**		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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Polychlorinated Biphenyls (PCBs)

Sample Name:	SD-101	**Units:**	ug/Kg
Lab Code:	K0600765-002	**Basis:**	Dry
Extraction Method:	EPA 3540C	**Level:**	Low
Analysis Method:	8082		

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	
Aroclor 1254	**27**	P	10	4.0	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	**31**		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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3540C
Analysis Method: 8082

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	
Aroclor 1254	**69**	P	15	6.0	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	**66**		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	
Aroclor 1254	**9.1**	JP	10	3.7	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1260	**8.4**	J	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:

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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3540C
Analysis Method: 8082

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	
Aroclor 1254	**6.1**	J	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:

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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3540C
Analysis Method: 8082

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	
Aroclor 1248	**13**		10	2.9	1	01/31/06	02/03/06	KWG0601729	
Aroclor 1254	**10**	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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3540C
Analysis Method: 8082

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:

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

Sample Name	Lab Code	Sur1
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

Surrogate Recovery Control Limits (%)

Sur1 = Decachlorobiphenyl	20-161

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Extracted:**	01/31/2006
Sample Matrix:	Soil	**Date Analyzed:**	02/03/2006

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

Sample Name:	REF-YB	**Units:**	ug/Kg
Lab Code:	K0600765-007	**Basis:**	Dry
Extraction Method:	EPA 3540C	**Level:**	Low
Analysis Method:	8082	**Extraction Lot:**	KWG0601729

		REF-YBMS KWG0601729-1 Matrix Spike			REF-YBDMS KWG0601729-2 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Expected**	**%Rec**	**Result**	**Expected**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
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

	Lab Control Sample KWG0601729-3 Lab Control Spike			
Analyte Name	**Result**	**Expected**	**%Rec**	**%Rec Limits**
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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Water	**Date Received:**	01/28/2006

Volatile Organics by GC/MS

Sample Name:	SW-100	**Units:**	ug/L
Lab Code:	K0600765-008	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260B		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Water	**Date Received:**	01/28/2006

Volatile Organics by GC/MS

Sample Name:	SW-101	**Units:**	ug/L
Lab Code:	K0600765-009	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260B		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Water	**Date Received:**	01/28/2006

Volatile Organics by GC/MS

Sample Name:	SW-102	**Units:**	ug/L
Lab Code:	K0600765-010	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260B		

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:

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:

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

Volatile Organics by GC/MS

Sample Name:	Method Blank	**Units:**	ug/L
Lab Code:	KWG0602100-4	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260B		

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

Volatile Organics by GC/MS

Sample Name:	Method Blank	**Units:**	ug/L
Lab Code:	KWG0602222-4	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260B		

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:

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

Sample Name	Lab Code	Sur1	Sur2	Sur3
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

Surrogate Recovery Control Limits (%)

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

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	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Extracted:**	02/07/2006
Sample Matrix:	Water	**Date Analyzed:**	02/07/2006

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

Sample Name:	Batch QC	**Units:**	ug/L
Lab Code:	K0600749-001	**Basis:**	NA
Extraction Method:	EPA 5030B	**Level:**	Low
Analysis Method:	8260B	**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.

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 Result	Expected	%Rec	%Rec Limits
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 Result	Expected	%Rec		%Rec Limits
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	
Phenol	**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	
Naphthalene	**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:

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	
Fluoranthene	**650**	JD	1100	480	100	02/02/06	02/15/06	KWG0601824	
Pyrene	**290**		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	
Benz(a)anthracene	**120**		11	3.1	1	02/02/06	02/14/06	KWG0601824	
Chrysene	**210**		11	3.1	1	02/02/06	02/14/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	**140**	J	220	3.7	1	02/02/06	02/14/06	KWG0601824	
Di-n-octyl Phthalate	**28**		11	2.6	1	02/02/06	02/14/06	KWG0601824	
Benzo(b)fluoranthene	**160**		11	5.4	1	02/02/06	02/14/06	KWG0601824	
Benzo(k)fluoranthene	**54**		11	5.4	1	02/02/06	02/14/06	KWG0601824	
Benzo(a)pyrene	**76**		11	3.5	1	02/02/06	02/14/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	**48**		11	4.1	1	02/02/06	02/14/06	KWG0601824	
Dibenz(a,h)anthracene	**11**		11	4.8	1	02/02/06	02/14/06	KWG0601824	
Benzo(g,h,i)perylene	**44**		11	5.0	1	02/02/06	02/14/06	KWG0601824	

Comments:

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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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	
Phenol	**11**	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	
4-Methylphenol†	**22**		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	
Naphthalene	**40**		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	
2-Methylnaphthalene	**20**		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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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	
Phenanthrene	**540**	JD	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	
Fluoranthene	**2000**	D	1300	540	100	02/02/06	02/15/06	KWG0601824	
Pyrene	**570**		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	
Benz(a)anthracene	**240**		13	3.5	1	02/02/06	02/14/06	KWG0601824	
Chrysene	**710**		13	3.5	1	02/02/06	02/14/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	**120**	J	250	4.2	1	02/02/06	02/14/06	KWG0601824	
Di-n-octyl Phthalate	**100**		13	3.0	1	02/02/06	02/14/06	KWG0601824	
Benzo(b)fluoranthene	**380**		13	6.2	1	02/02/06	02/14/06	KWG0601824	
Benzo(k)fluoranthene	**120**		13	6.2	1	02/02/06	02/14/06	KWG0601824	
Benzo(a)pyrene	**160**		13	4.0	1	02/02/06	02/14/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	**96**		13	4.7	1	02/02/06	02/14/06	KWG0601824	
Dibenz(a,h)anthracene	**19**		13	5.4	1	02/02/06	02/14/06	KWG0601824	
Benzo(g,h,i)perylene	**74**		13	5.7	1	02/02/06	02/14/06	KWG0601824	

Comments:

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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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	
Phenol	**19**	J	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	
4-Methylphenol†	**25**		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	
Naphthalene	**160**		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	
2-Methylnaphthalene	**60**		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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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	
Phenanthrene	**620**	JD	1900	480	100	02/02/06	02/15/06	KWG0601824	
Anthracene	**700**	JD	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	
Fluoranthene	**4100**	D	1900	820	100	02/02/06	02/15/06	KWG0601824	
Pyrene	**1100**		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	
Benz(a)anthracene	**920**		19	5.2	1	02/02/06	02/14/06	KWG0601824	
Chrysene	**2500**	D	1900	520	100	02/02/06	02/15/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	**160**	J	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	
Benzo(b)fluoranthene	**1400**	JD	1900	930	100	02/02/06	02/15/06	KWG0601824	
Benzo(k)fluoranthene	**300**		19	9.3	1	02/02/06	02/14/06	KWG0601824	
Benzo(a)pyrene	**450**		19	6.0	1	02/02/06	02/14/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	**280**		19	7.1	1	02/02/06	02/14/06	KWG0601824	
Dibenz(a,h)anthracene	**56**		19	8.2	1	02/02/06	02/14/06	KWG0601824	
Benzo(g,h,i)perylene	**210**		19	8.5	1	02/02/06	02/14/06	KWG0601824	

Comments:

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	
Phenol	**7.0**	J	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	
4-Methylphenol†	**8.7**	J	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	
Naphthalene	**6.9**	J	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	
2-Methylnaphthalene	**8.3**	J	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	
Acenaphthylene	**15**		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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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:

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Semi-Volatile Organic Compounds by GC/MS

Sample Name:	SD-103	**Units:**	ug/Kg
Lab Code:	K0600765-004	**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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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:

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	
Phenanthrene	**8.6**	J	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	
Fluoranthene	**20**		12	4.9	1	02/02/06	02/15/06	KWG0601824	
Pyrene	**22**		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	
Benz(a)anthracene	**10**	J	12	3.2	1	02/02/06	02/15/06	KWG0601824	
Chrysene	**18**		12	3.2	1	02/02/06	02/15/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	**7.6**	J	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	
Benzo(b)fluoranthene	**15**		12	5.6	1	02/02/06	02/15/06	KWG0601824	
Benzo(k)fluoranthene	**5.8**	J	12	5.6	1	02/02/06	02/15/06	KWG0601824	
Benzo(a)pyrene	**11**	J	12	3.6	1	02/02/06	02/15/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	**8.8**	J	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	
Benzo(g,h,i)perylene	**9.3**	J	12	5.1	1	02/02/06	02/15/06	KWG0601824	

Comments:

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Semi-Volatile Organic Compounds by GC/MS

Sample Name:	SD-104	**Units:**	ug/Kg
Lab Code:	K0600765-005	**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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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	
Phenol	**8.0**	J	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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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	
Phenanthrene	**4.1**	J	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	
Fluoranthene	**12**		11	4.5	1	02/02/06	02/15/06	KWG0601824	
Pyrene	**15**		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	
Benz(a)anthracene	**6.6**	J	11	2.9	1	02/02/06	02/15/06	KWG0601824	
Chrysene	**9.3**	J	11	2.9	1	02/02/06	02/15/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	**6.1**	J	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	
Benzo(b)fluoranthene	**11**	J	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	
Benzo(a)pyrene	**9.3**	J	11	3.3	1	02/02/06	02/15/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	**7.3**	J	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	
Benzo(g,h,i)perylene	**7.8**	J	11	4.7	1	02/02/06	02/15/06	KWG0601824	

Comments:

Client:	Kennedy/Jenks Consultants, Incorporated	**Service Request:**	K0600765
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**Date Received:**	01/28/2006

Semi-Volatile Organic Compounds by GC/MS

Sample Name:	REF-EBB	**Units:**	ug/Kg
Lab Code:	K0600765-006	**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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3541
Analysis Method: 8270C

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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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	
Phenanthrene	**3.7**	J	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	
Fluoranthene	**11**		10	3.9	1	02/02/06	02/14/06	KWG0601824	
Pyrene	**13**		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	
Benz(a)anthracene	**5.8**	J	10	2.5	1	02/02/06	02/14/06	KWG0601824	
Chrysene	**8.6**	J	10	2.5	1	02/02/06	02/14/06	KWG0601824	
Bis(2-ethylhexyl) Phthalate	**3.7**	J	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	
Benzo(b)fluoranthene	**10**		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	
Benzo(a)pyrene	**9.3**	J	10	2.9	1	02/02/06	02/14/06	KWG0601824	
Indeno(1,2,3-cd)pyrene	**7.7**	J	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	
Benzo(g,h,i)perylene	**9.3**	J	10	4.1	1	02/02/06	02/14/06	KWG0601824	

Comments:

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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3541
Analysis Method: 8270C

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:

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

Extraction Method: EPA 3541
Analysis Method: 8270C

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:

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

Sample Name	Lab Code	Sur1	Sur2	Sur3	Sur4	Sur5	Sur6
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.

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

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3541
Analysis Method: 8270C

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.

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

	Lab Control Sample KWG0601824-3 Lab Control Spike			Duplicate Lab Control Sample KWG0601824-4 Duplicate Lab Control Spike					
Analyte Name	**Result**	**Expected**	**%Rec**	**Result**	**Expected**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
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.

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

	Lab Control Sample KWG0601824-3 Lab Control Spike				Duplicate Lab Control Sample KWG0601824-4 Duplicate Lab Control Spike					
Analyte Name	**Result**	**Expected**	**%Rec**		**Result**	**Expected**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
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

Units: ug/L
Basis: NA

Extraction Method: EPA 3520C
Analysis Method: 8270C SIM

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

Units: ug/L
Basis: NA

Extraction Method: EPA 3520C
Analysis Method: 8270C SIM

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:

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

Units: ug/L
Basis: NA

Extraction Method: EPA 3520C
Analysis Method: 8270C SIM

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	
Benzo(k)fluoranthene	**0.0017**	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	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:

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

Sample Name	Lab Code	Sur1	Sur2	Sur3
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

	Lab Control Sample KWG0601710-3 Lab Control Spike			Duplicate Lab Control Sample KWG0601710-5 Duplicate Lab Control Spike					
Analyte Name	**Result**	**Expected**	**%Rec**	**Result**	**Expected**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**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	**Units:**	ug/L
Lab Code:	K0601413-001	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**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	**Units:**	ug/L
Lab Code:	K0601413-002	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**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	**Units:**	ug/L
Lab Code:	K0601413-003	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**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	**Units:**	ug/L
Lab Code:	K0601413-004	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**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	**Units:**	ug/L
Lab Code:	K0601413-005	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**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	**Units:**	ug/L
Lab Code:	K0601413-006	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	01/26/2006
Sample Matrix:	Soil	**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	**Units:**	ug/L
Lab Code:	K0601413-007	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Collected:**	NA
Sample Matrix:	Aqueous equip b	**Date Received:**	NA
		Date Prepared:	02/28/2006

Extraction Method Specified in Analytical Method
Butyltins in Porewater (as cation)

Sample Name:	Method Blank	**Units:**	ug/L
Lab Code:	KWG0603363-3	**Basis:**	NA
Preparation Method	METHOD	**Level:**	Low
Extraction Method:	EPA 3520C		
Analysis Method:	Krone		

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 **Service Request:** K0601413
Project: Astoria Area-Wide/0592004.00
Sample Matrix: Soil

Surrogate Recovery Summary
Extraction Method Specified in Analytical Method
Butyltins in Porewater (as cation)

Preparation Method METHOD **Units:** PERCENT
Extraction Method: EPA 3520C **Level:** Low
Analysis Method: Krone

Sample Name	Lab Code	Sur1
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

Surrogate Recovery Control Limits (%)

Sur1	= Tri-n-propyltin	23-137

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	**Service Request:**	K0601413
Project:	Astoria Area-Wide/0592004.00	**Date Prepared:**	02/28/2006
Sample Matrix:	Aqueous equip b	**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	**Units:**	ug/L
Analysis Method:	Krone	**Basis:**	NA
		Level:	Low
		Extraction Lot:	KWG0603363

	Lab Control Sample KWG0603363-1 Lab Control Spike			Duplicate Lab Control Sample KWG0603363-2 Duplicate Lab Control Spike					
Analyte Name	**Result**	**Expected**	**%Rec**	**Result**	**Expected**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
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

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 ≤0.40 µm, 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 ± 0.7°C; pH, 7.9 ± 0.1; salinity, 27.5 ± 2.7‰; and dissolved oxygen 8.8 ± 0.3 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 x ([initial amphipods - surviving amphipods]/initial amphipods)
Percent Survivors not Reburied = 100 x ([surviving amphipods - number survivors reburied]/surviving amphipods)
Percent Total Effective Mortality = 100 x ([initial amphipods - surviving amphipods]+ [surviving amphipods - number survivors reburied])/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 ± 1.0‰ (minimum 25.0‰, maximum 31.0‰).
2. Six temperature readings, on days 5 and 6, exceeded the protocol-specified range of 15.0 ± 1.0°C (maximum 16.3°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 (≤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 (≤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

Michele I. 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 amphipod, *Eohaustorius estuarius*, exposed to estuarine sediments.

Parameter	Mean ± SD	Minimum	Maximum	N
Temperature (°C)	15.4 ± 0.5	14.4	16.3	88
pH	7.8 ± 0.2	7.0	8.1	88
Salinity (‰)	27.8 ± 1.7	25.0	31.0	88
Dissolved oxygen (mg/L)	8.0 ± 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 ± SD	Minimum	Maximum	N
Salinity (‰)	21.4 ± 6.4	13.0	29.0	16
pH	6.8 ± 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[1] (no./replicate)	Percent mortality		Percent Survivors Failing to Rebury	Percent Total Effective Mortality
Control (NAS #0438G)	0.0 ± 0.0	1.0 ± 2.2		0.0 ± 0.0	1.0 ± 2.2
REF-EBB (NAS #0426G)[2]	4.2 ± 3.2	23.0 ± 13.5		0.0 ± 0.0	23.0 ± 13.5
REF-YB (NAS #0427G)[2]	1.4 ± 1.9	61.0 ± 6.5		0.0 ± 0.0	61.0 ± 6.5
SD-100 (NAS #0421G)	66.2 ± 20.2	100.0 ± 0.0	*	----	100.0 ± 0.0
SD-101 (NAS #0422G)	79.2 ± 21.1	100.0 ± 0.0	*	----	100.0 ± 0.0
SD-102 (NAS #0423G)	85.2 ± 19.0	100.0 ± 0.0	*	----	100.0 ± 0.0
SD-103 (NAS #0424G)	15.6 ± 9.4	61.0 ± 8.2	*	0.0 ± 0.0	61.0 ± 8.2
SD-104 (NAS #0425G)	5.8 ± 5.4	24.0 ± 6.5		0.0 ± 0.0	24.0 ± 6.5

[1] Daily emergence counts include all amphipods observed on or above the sediment surface, whether living or dead.
[2] 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 ± 2.2	---	---	---	---	---
REF-EBB (NAS #0426G)[1]	23.0 ± 13.5	---	22.0	---	---	---
REF-YB (NAS #0427G)[1]	61.0 ± 6.5	---	60.0	---	---	---
SD-100 (NAS #0421G)	100.0 ± 0.0	YES	99.0	77.0	YES	YES
SD-101 (NAS #0422G)	100.0 ± 0.0	YES	99.0	77.0	YES	YES
SD-102 (NAS #0423G)	100.0 ± 0.0	YES	99.0	77.0	YES	YES
SD-103 (NAS #0424G)	61.0 ± 8.2	YES	60.0	38.0	YES	YES
SD-104 (NAS #0425G)	24.0 ± 6.5	NO	23.0	1.0	NO	NO

[1] 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. estuarius* is a desirable test species for sediments with interstitial water salinity of 2-28 ppt, and the use of the *E. estuarius* 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 μm, 1 μm, and 0.40 μm cartridge filters. An alternative seawater supply of similar quality may be used. Seawater should be held at ≤15°C for ≤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 ± 1°C. The selected test salinity is kept within ± 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
Biological Data	
Emergence from sediment	daily
Survival	end of test
Reburial	end of test
Physical and Chemical Data	
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^{2-} (Standard Methods 1995 (19^{th} 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 ≤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

ASTM. 2004. Standard test method for measuring the toxicity of sediment-associated contaminants with estuarine and marine invertebrates. ASTM Standard Method No. E1367-03e1. In: 2004 Annual Book of ASTM Standards, volume 11.05, Biological effects and environmental fate; biotechnology; pesticides. ASTM International, West Conshohocken, PA.

DeWitt, T.H., R.C. Swartz and J.O. Lamberson. 1989. Measuring the acute toxicity of estuarine sediments. Environ. Toxicol. Chem. 8: 1035-1048.

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, P.O. Box 40900, Olympia, WA.

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.) 1993. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms (Fourth Edition). EPA/600/4-90/027F.

12. APPROVALS

_____ for _____
Name Date

_____ for **NORTHWESTERN AQUATIC SCIENCES**
Name Date

APPENDIX II

RAW DATA

TEST DESCRIPTION, MONITORING, AND RESULTS BENCHSHEETS

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

reviewed p. 1-63 MLR 6-13-06

Test No. 738-1 Client Kennedy/Jenks Investigator

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 MSR

QA Officer L.K. Nemeth

1. Bill Montgomery WM
2. G.J. IRISSARRI GJI
3. Susan Cafe SC
4. [illegible]
5. R.S. Caldwell
6. Greg Hutchinson GH
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.:	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):					

Error codes: 1) correction of handwriting error
2) written in wrong location; entry deleted
3) wrong date deleted, replaced with corrrect date
4) error found in measurement; measurement repeated

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

SEDIMENT DESCRIPTIONS -- SUPPLEMENTAL NOTES

Sample No.	Description
0421G	black mud with) woody and grassy debris; petroleum smell
0422G	black mud with chunks of wood
0423G	dark brown mud with fibrous material and sticks; petroleum smell
0424G	black mud w/ woody debris
0425G	black sticky mud
0426G	black sticky mud
0427G	black sticky mud with) some sand
0438G	brown sand

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

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 amount	Feeding description	Water changes	Comments
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 +/- 1.0

Salinity (ppt): 28.0 +/- 1.0

MISCELLANEOUS NOTES

Light intensity measurements:

Date	Location in room	foot-candles
2-21-06	beaker #14	121
	#43	103

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

Control Sediment:

Source: Yaquina Bay, Oregon

Date collected: 2-14-06 Interstitial salinity: 5.0 ppt

Sieved through 0.5 -mm screen

Storage: 4 degrees C in the dark NAS# 0438G

Test conducted in (circle one): room 1 room 2 trailer water bath other: room #4

Randomization chart: wall

upper shelf

lower

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

POST

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 water

Date of Collection: 2-15-06 Salinity (ppt) 28.0 pH _____

Treatments: filtered to 0.4 µm, salinity-adjusted with MilliQ deionized water, aerated

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

overlying NH3 sampled (days 0,10)? yes

Day 0 (2/17/06) mm/MSR 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	3		
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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 0 (2 14 06) ww/mst

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					4	OK	
42					2		
* 43	15.0	7.7	26.5	8.4	3		
44							
* 45	15.1	7.9	27.0	8.4	0		
46					3		
47					6		
48					5		
49					4		
50							
51					1		
52					1		
53							
54					0		
55					5		
56					1		

* Water Quality Beakers [shaded] day zero beakers

** for day zero only, this is number not buried within 10-15 minutes

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 1 (2/18/06) 6J2

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

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-EE4
MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator [redacted]

DAILY RECORD SHEET

Day 1 (2/18/06) 6S2

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					18	ALL	
42					1	OK	
* 43	15.5	7.6	26.0	7.8	19		
44							
* 45	15.2	8.0	26.0	8.1	0		
46					20		
47					14		
48					17		
49					18		
50							
51					13		
52					12		
53							
54					0		
55					16		
56					0		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 2 (2/19/06) GJ2

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	8.4	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

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-EE4
MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 2 (2 /19 /06) 602

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					15	ALL	
42					0	OK	
* 43	15.4	7.7	25.5	8.0	18		
44							
* 45	15.3	8.0	26.0	8.2	0		
46					13		
47					8		
48					5		
49					17		
50							
51					9		
52					1		
53							
54					0		
55					8		
56					0		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator [redacted]

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 on	
2					0		DO measurements for this day are incorrect; instrument was set to freshwater instead of 28ppt. The problem was not caught in time to re-measure. MSK 3-31-06
* 3	14.8	7.6	28.0	10.2	6		
4							
* 5	14.9	7.7	27.5	10.4	1		
6					5		
* 7	14.8	7.9	28.0	10.6	0		
8					0		
* 9	14.8	7.8	28.0	10.6	6		
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					6		
25					7		
26					0		
* 27	14.4	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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XX[illegible]-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator [illegible]

DAILY RECORD SHEET

Day 3 (2/20/06) GH

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					8	All ok	
42					0		
* 43	15.0	7.6	26.0	10.2	13		
44							
* 45	15.0	7.9	27.0	10.6	0		
46					8		
47					3		
48					2		
49					10		
50							
51					5		
52					2		
53							
54					0		
55					2		
56					0		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES — PROTOCOL NO. NAS-XXX-EE4

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/GH

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0	All on	
2					0		DO measurements for this day are incorrect; instrument was set for freshwater rather than 28 ppt. The problem was not caught in time to re-measure. MSR 3-31-06
* 3	15.3	7.6	28.0	9.4	4		
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		
10					0		
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		6.5 3-21-06			0 @ GH	3-21-06	
* 38	15.8	7.86	25.0	8.8	5		
39					0		
40							

* Water Quality Beakers — day zero beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 4 (2/21/06) GH/mm

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					3	All GH	
42					0		
* 43	15.5	7.6	26.0	9.2	3		
44							
* 45	15.5	7.6	27.0	9.4	0		
46					7		
47					5		
48					7		
49					8		
50							
51					0		
52					0		
53							
54					0		
55					4		
56					0		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 5 (2/22/06)

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
1					0	Weight	
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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 5 (2 22 06) cm

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					10	~~OK~~	
42					7		
* 43	16.2	7.7	26.0	7.8	0		
44							
* 45	16.2	8.0	27.0	8.0	0		
46					8		
47					4		
48					0		
49					8		
50							
51					3		
52					0		
53							
54					0		
55					8		
56					0		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

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					9		
14					8		
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

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-EE4
MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator

DAILY RECORD SHEET

Day 6 (2/23/06) SF

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					10	OK	
42					0		
* 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		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 7 (2/24/06) NSW

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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator

DAILY RECORD SHEET

Day 7 (2 24 06) [illegible]

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	~~7.0~~ 7.4	8		
44							
* 45	16.0	8.0	29.0	7.9	0		
46					7		
47					~~7~~ 7		
48					7		
49					7		
50							
51					0		
52					0		
53							
54					0		
55					6		
56					0		

* Water Quality Beakers

day zero beakers

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 8 (2 5 10 6) 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	7.7	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					4		
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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator [redacted]

DAILY RECORD SHEET

Day 8 (2/25/06) SV

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					5	AC	
42					0	OK	
* 43	15-8	7-8	27.5	7.6	9		
44							
* 45	15-8	8.1	29.5	7.9	0		
46					9		
47					7		
48					0		
49					7		
50							
51					0		
52					0		
53							
54					0		
55					8		
56					0		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

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	ALLOK	
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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 9 (2-26 1000) VB

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					6	AUCK	
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					10		
52					0		
53							
54					0		
55					8		
56					0		

* Water Quality Beakers day zero beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator

DAILY RECORD SHEET

overlying NH3 sampled (days 0,10)? yes

Day 10 (2/27/06) GH overlying 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				(2) GH	0		
* 3	14.9	7.7	30.0	~~9.7~~ 8.0	1		
4							
* 5	14.6	8.1	29.5	~~9.6~~ 8.0	1		
6				(3) GH	3		
* 7	14.8	7.9	31.0	~~10.0~~ 8.1	0		
8				(4) GH	2		
* 9	14.7	8.1	30.0	~~9.8~~ 8.2	1		
10				(5) GH	0		
11				2-27-06	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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator [redacted]

DAILY RECORD SHEET

Day 10 (2/27/06) GH

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. ** emerged	Air	Comments
41					6	All ok	
42					0		
* 43	15.0	8.1	26.3	8.2	4		
44							
* 45	14.9	8.1	28.0	8.0	1		
46					4		
47					5		
48					4		
49					3		
50							
51					0		
52					1		
53							
54					0		
55					5		
56					0		

* Water Quality Beakers [redacted] day zero beakers

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-EE4

MARINE AMPHIPOD 10-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

DAY 10 TEST TERMINATION SHEET

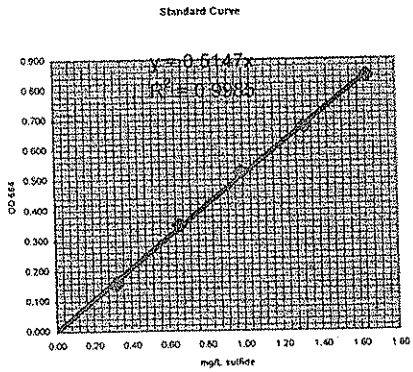
Beaker No.	No. of Survivors	Number reburied	Initial	Comment
1	11	11	MSR	+1 dead
2	20	20	GH	
3				
4				
5				
6	0	0	GH	+8 dead
7				
8	18	18	MSR	
9				
10	20	20	GH	
11	9	9	MSR	
12	6	6	GH	+2 dead
13	Ø	Ø	wpm	+9 dead
14	Ø	—	MSR	+4 dead
15	16	16	wpm	
16	7	7	GH	+4 dead
17	8	8	wpm	+5 dead
18	5	5	MSR	+6 dead
19	8	8	wpm	+2 dead
20	14	14	GH	+1 dead
21	9	9	wpm	+3 dead
22	Ø	—	MSR	+6 dead
23	Ø	—	wpm	+10 dead
24	19	19	GH	+1 dead
25	Ø	—	wpm	+7 dead
26	17	17	MSR	
27	16	16	wpm	+1 dead
28	0	0	GH	+1 dead
29	Ø	—	wpm	+4 dead
30				
31	17	17	wpm	
32				
33	15	15	GH	
34	Ø	—	wpm	
35	20	20	wpm	
36				
37	used as a WQ beaker instead of #27			
38				
39	14	14	wpm	
40				

Beaker No.	No. of Survivors	Number reburied	Initial	Comment
41	Ø	—	MSR	+6 dead
42	15	15	GH	+3 dead
43				
44				
45				
46	Ø	—	wpm	+8 dead
47	Ø	—	MSR	+7 dead
48	Ø	—	wpm	+5 dead
49	Ø	—	GH	
50				
51	9		MSR	+1 dead
52	8	8	wpm	+3 dead
53				
54	20	20	MSR	
55	Ø	—	wpm	+7 dead
56	9	9	GH	+6 dead

water quality or day zero beakers

Dissolved Sulfide in Water: Computation Worksheet
Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	96	97	97
Working Std. Conc. (mg/L):		1.65333	



Result

	Sample description	Dilution factor	OD_{664}	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
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28				
29.				
30.				
31.				
32.				
33.				
34.				
35.				
36.				

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

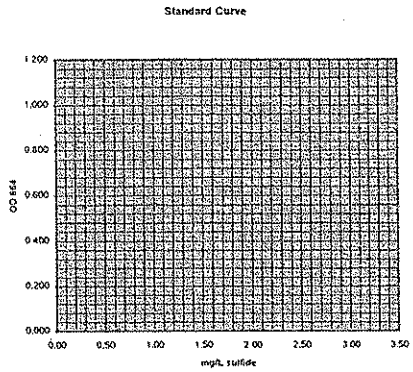
Dissolved Sulfide in Water: Computation Worksheet

Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	96	97	97
Working Std. Conc. (mg/L):		3.2	

Result

	Sample description	Dilution factor	OD_{664}	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.	-----	.845	3.20
	3.0 mL spike	-----	.53	
	3.0 mL spike dupl.	-----	.525	
1.	0421G (SD-100)	5	.000	
2.	0422G (SD-101)	5	.002	
3.	0423G (SD-102)	5	.004	
4.	0424G (SD-103)	5	.000	
5.	0425G SD-104)	5	.000	
6.	0426G (REF-EBB)	5	.000	
7.	0427G (REF-YB)	5	.000	
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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.: P738

Test Day: Bulk sediment

Species: *NA*

Sediment pore water

Analyst: RSC

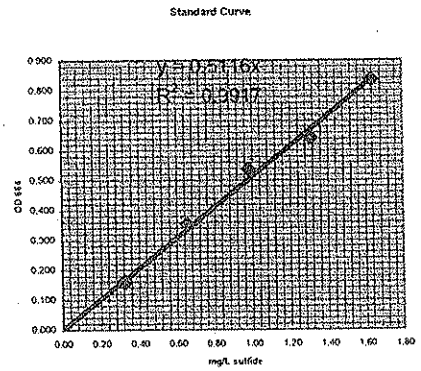
Date analysed: 2/16/2006

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_{664}	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
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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

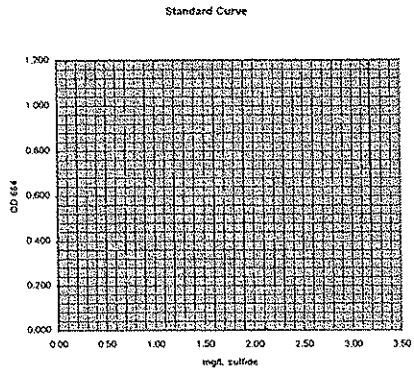
Dissolved Sulfide in Water: Computation Worksheet

Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	98	99	96
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.	-----	.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	-----	.528	
	3.0 mL spike dupl.	-----	.532	
1.	3	5	.100	
2.	5	5	.000	
3.	7	5	.002	
4.	9	5	.000	
5.	27	5	.004	
6.	38	5	.000	
7.	43	5	.000	
8.	45	5	.000	
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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.: 738-1

Test Day: 0 (2-17-06)

Species: *Eohaustorius*

overlying water

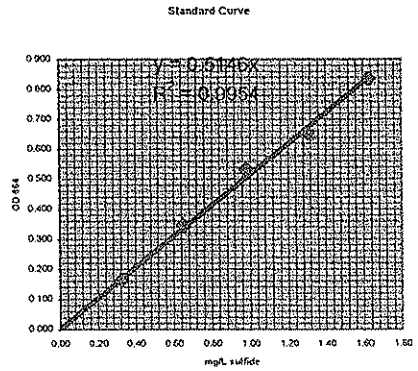
Analyst: RSC

Date analysed: 2/17/2006

Dissolved Sulfide in Water: Computation Worksheet

Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	99	97	98
Working Std. Conc. (mg/L):		1.632	



Result

	Sample description	Dilution factor	OD664	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
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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

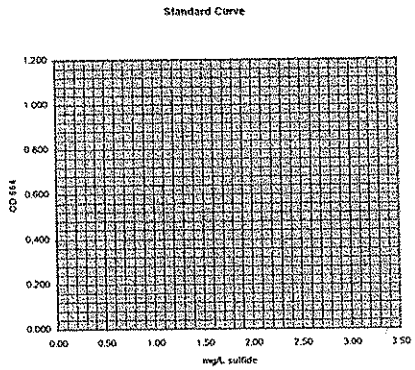
Date analysed: 2/27/2006

Dissolved Sulfide in Water: Computation Worksheet
Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	97	97	97
Working Std. Conc. (mg/L):		3.2	

Result

	Sample description	Dilution factor	OD664	Sulfide (mg/L)
	Blank	-----	.165	-----
	1.0 mL working sulfide std.	-----	.345	0.64
	2.0 mL working sulfide std.	-----	.532	1.28
	3.0 mL working sulfide std.	-----	.659	1.92
	4.0 mL working sulfide std.	-----	.935	2.56
	5.0 mL working sulfide std.	-----		3.20
	3.0 mL spike	-----	.565	
	3.0 mL spike dupl.	-----	.517	
1.	3	5	.000	
2.	5	5	.000	
3.	7	5	.002	
4.	9	5	.001	
5.	37	5	.000	
6.	38	5	.002	
7.	43	5	.004	
8.	45	5	.001	
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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.: 738-1

Test Day: 10 (2-27-06)

Species: *Eohaustorius*

overlying water

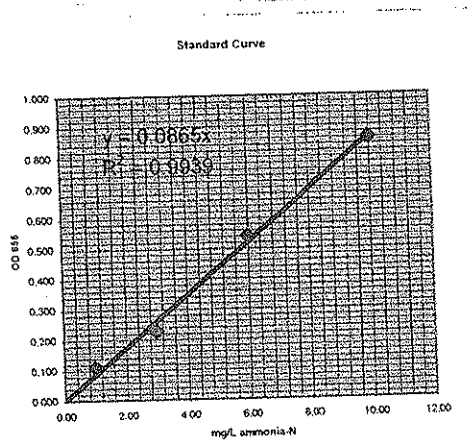
Analyst: RSC

Date analysed: 2/27/2006

Total Ammonia-N in Sediment Pore Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)	pH	Salinity (ppt)
	Blank	-----	-----	-----		
	1.0 mg/L NH_3-N Std.	-----	0.110	1.00		
	3.0 mg/L NH_3-N Std.	-----	0.227	3.00		
	6.0 mg/L NH_3-N Std.	-----	0.540	6.00		
	10.0 mg/L NH_3-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

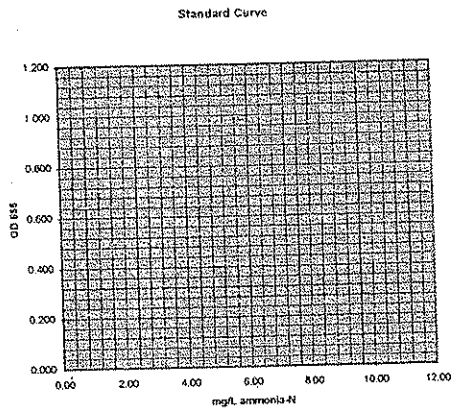
Analyst: RSC
Date analysed: 2/16/2006

Total Ammonia-N in Sediment Pore Water: Computation Worksheet

Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)	pH	Salinity (ppt)
	Blank	-----	----	----		
	1.0 mg/L NH_3-N Std.	-----	.110	1.00		
	3.0 mg/L NH_3-N Std.	-----	.227	3.00		
	6.0 mg/L NH_3-N Std.	-----	.590	6.00		
	10.0 mg/L NH_3-N Std.	-----	.868	10.00		
	3.0 mg/L spike	-----	.215			
	3.0 mg/L spike dupl.	-----	.213			
	5.0 mg/L 2nd source		.360			
1.	0421G (SD-100)	5	.106		6.9	1.5
2.	0422G (SD-101)	5	.228		7.1	3.0
3.	0423G (SD-102)	5	.052		7.4	1.0
4.	0424G (SD-103)	5	.187		7.2	4.5
5.	0425G SD-104)	5	.244		7.3	5.0
6.	0426G (REF-EBB)	5	.205		7.2	5.0
7.	0427G (REF-YB)	5	.224		7.7	2.0
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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.: P738
Test Day: NA
Species: *NA*

Bulk Sediment porewaters

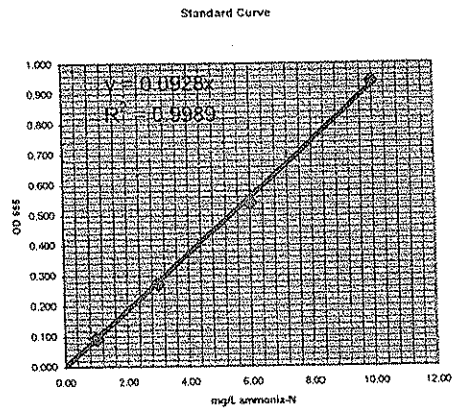
Analyst: RSC
Date analysed: 2/16/2006

Total Ammonia-N in Sediment Pore Water: Computation Worksheet

Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)	pH	Salinity (ppt)
	Blank	-----	----	----		
	1.0 mg/L NH_3-N Std.	-----	0.092	1.00		
	3.0 mg/L NH_3-N Std.	-----	0.272	3.00		
	6.0 mg/L NH_3-N Std.	-----	0.540	6.00		
	10.0 mg/L NH_3-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		
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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

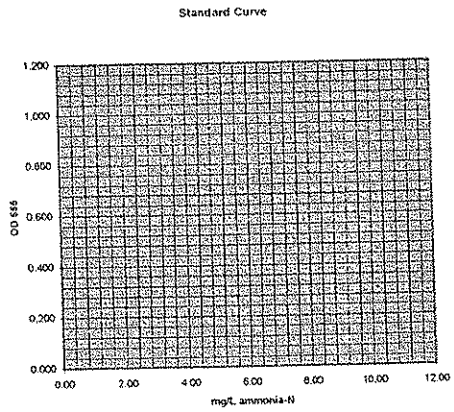
Sediment porewaters

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	NH_3-N (mg/L)	pH	Salinity (ppt)
	Blank	-----	-----	-----		
	1.0 mg/L NH_3-N Std.	-----	.094	1.00		
	3.0 mg/L NH_3-N Std.	-----	.272	3.00		
	6.0 mg/L NH_3-N Std.	-----	.540	6.00		
	10.0 mg/L NH_3-N Std.	-----	.940	10.00		
	3.0 mg/L spike	-----	.278			
	3.0 mg/L spike dupl.	-----	.265			
	5.0 mg/L 2nd source		.422			
1.	4	5	.100		6.5	13.0
2.	30	5	.318		6.5	14.0
3.	32	5	.308		7.2	16.0
4.	36	5	.357		6.6	14.0
5.	40	5	.013		7.5	23.0
6.	44	5	.325		6.8	15.0
7.	50	5	.299		6.7	16.0
8.	53	5	.147		6.6	14.0
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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: 0 (2-17-06)
Species: Eohaustorius

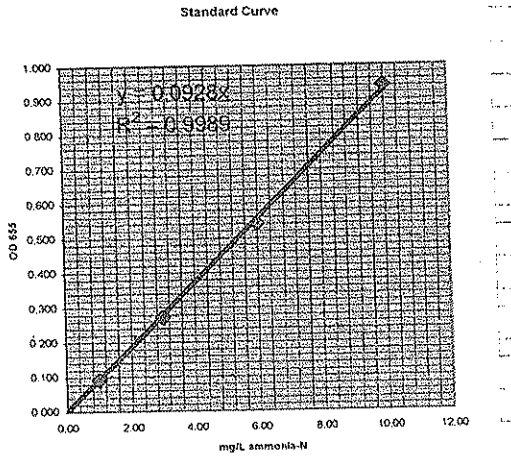
~~Bulk~~ Sediment porewaters

Analyst: RSC
Date analysed: 2/17/2006

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	-----	-----	-----
	1.0 mg/L NH_3-N Std.	-----	0.092	1.00
	3.0 mg/L NH_3-N Std.	-----	0.272	3.00
	6.0 mg/L NH_3-N Std.	-----	0.540	6.00
	10.0 mg/L NH_3-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
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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

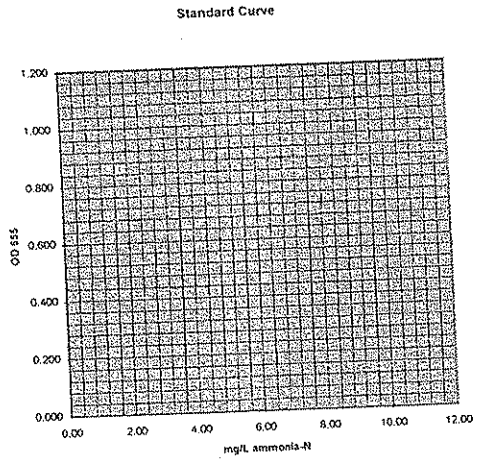
Overlying water

Analyst: RSC
Date analysed: 2/17/2006

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	----	----	----
	1.0 mg/L NH_3-N Std.	----	.092	1.00
	3.0 mg/L NH_3-N Std.	----	.272	3.00
	6.0 mg/L NH_3-N Std.	----	.540	6.00
	10.0 mg/L NH_3-N Std.	----	.940	10.00
	3.0 mg/L spike	----	.275	
	3.0 mg/L spike dupl.	----	.265	
	5.0 mg/L 2nd source	----	.422	
1.	3	1	.145	
2.	5	1	.258	
3.	7	1	.017	
4.	9	1	.290	
5.	27	1	.232	
6.	38	1	.079	
7.	43	1	.258	
8.	45	1	.270	
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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.: 738-1
Test Day: 0 (2-17-06)
Species: Eohaustorius

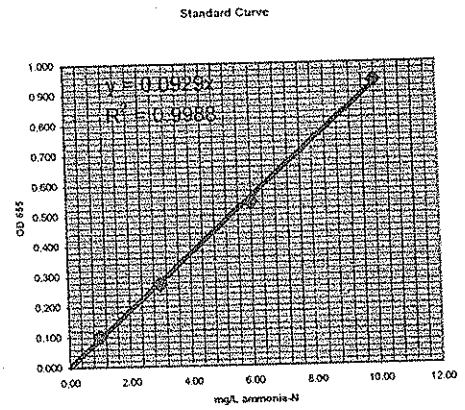
Overlying water

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	OD655	NH_3-N (mg/L)	pH	Salinity (ppt)
	Blank	-----	-----	-----		
	1.0 mg/L NH_3-N Std.	-----	0.102	1.00		
	3.0 mg/L NH_3-N Std.	-----	0.272	3.00		
	6.0 mg/L NH_3-N Std.	-----	0.542	6.00		
	10.0 mg/L NH_3-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		
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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

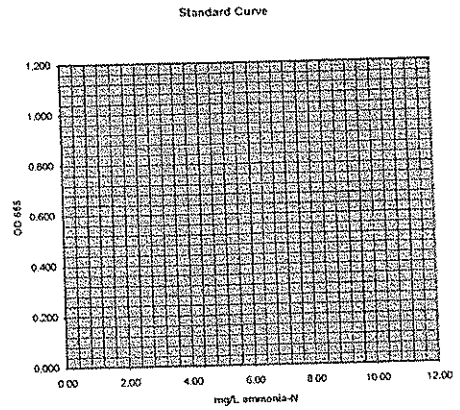
Sediment porewaters

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	OD655	NH3-N (mg/L)	pH	Salinity (ppt)
	Blank	-----	----	----		
	1.0 mg/L NH3-N Std.	-----	.102	1.00		
	3.0 mg/L NH3-N Std.	-----	.272	3.00		
	6.0 mg/L NH3-N Std.	-----	.542	6.00		
	10.0 mg/L NH3-N Std.	-----	.940	10.00		
	3.0 mg/L spike	-----	.288			
	3.0 mg/L spike dupl.	-----	.283			
	5.0 mg/L 2nd source		.542			
1.	3	5	.410		6.7	29.0
2.	5	5	.640		6.5	28.0
3.	7	5	.040		7.6	27.5
4.	9	5	.568		6.7	29.0
5.	37	5	.508		6.6	29.0
6.	38	5	.520		6.4	25.0
7.	43	5	.826		6.4	26.0
8.	45	5	.720		7.0	27.0
9.						
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34						
35						
36						



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

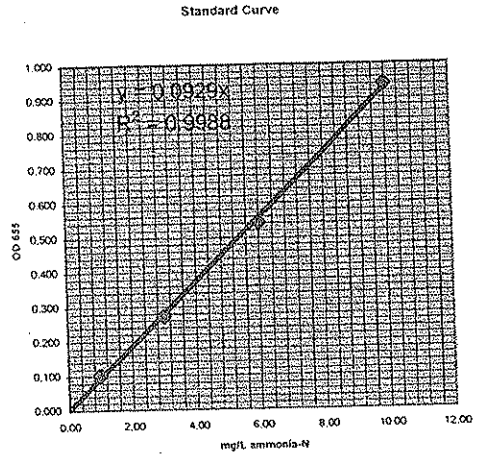
Analyst: RSC
Date analysed: 2/27/2006

Total Ammonia-N in Water: Computation Worksheet

Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	-----	----	----
	1.0 mg/L NH_3-N Std.	-----	0.102	1.00
	3.0 mg/L NH_3-N Std.	-----	0.272	3.00
	6.0 mg/L NH_3-N Std.	-----	0.542	6.00
	10.0 mg/L NH_3-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
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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

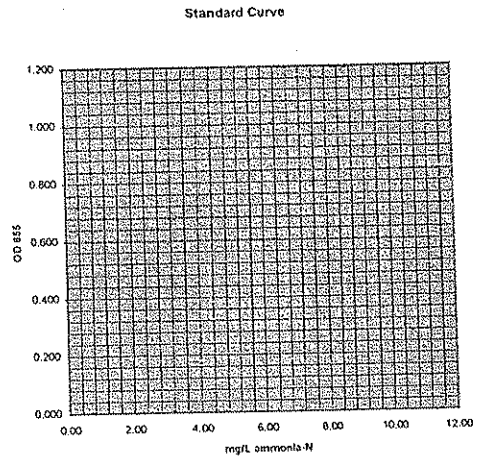
Overlying water

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_3-N (mg/L)
	Blank	-----	----	----
	1.0 mg/L NH_3-N Std.	-----	.102	1.00
	3.0 mg/L NH_3-N Std.	-----	.292	3.00
	6.0 mg/L NH_3-N Std.	-----	.542	6.00
	10.0 mg/L NH_3-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	.150	
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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.: 738-1
Test Day: 10 (2-27-06)
Species: Eohaustorius

Overlying water

Analyst: RSC
Date analysed: 2/27/2006

TEST DATA ANALYSIS RECORDS

BKR	NAS SMPL	CLIENT 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

Endpoints Data Entry and Calculations File

INIT=initial number
SURV=number survivors
REBUR=number survivors which reburied
MORT=number dead=INIT-SURV
NOBURY=number survivors not reburied=SURV-REBUR
TEM=total effective mortality=MORT+NOBURY

PSURV=%survival=100(SURV/INIT)
PMORT=%mortality=100(MORT/INIT)
PBURY=%reburial=100(REBUR/SURV)
PNOBURY=%survivors not reburied=100(NOBURY/SURV)
PTEM=%total effective mortality=100(TEM/INIT)

Data entry verified against laboratory bench sheets - MK 2-27-06

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL		INIT	SURV	REBUR	MORT	NO-BURY	TEM	PSURV	PMORT	PBURY	PNO-BURY	PTEM		SURV	MORT	NO-BURY	PSURV	PMORT	PBURY	PNO-BURY	PTEM
1	22	0421G	SD-100	1		20	0		20		20	0.0	100.0			100.0									
2	13	0421G	SD-100	2		20	0		20		20	0.0	100.0			100.0	Mean	0.0	20.0		0.0	100.0			100.0
3	28	0421G	SD-100	3		20	0		20		20	0.0	100.0			100.0	SD	0.0	0.0		0.0	0.0			0.0
4	14	0421G	SD-100	4		20	0		20		20	0.0	100.0			100.0	n	5	5		5	5			5
5	55	0421G	SD-100	5		20	0		20		20	0.0	100.0			100.0									
6	3	0421G	SD-100	6	wq repl	20																			
7	53	0421G	SD-100	7	day0 bkr																				
8	49	0422G	SD-101	1		20	0		20		20	0.0	100.0			100.0									
9	48	0422G	SD-101	2		20	0		20		20	0.0	100.0			100.0	Mean	0.0	20.0		0.0	100.0			100.0
10	41	0422G	SD-101	3		20	0		20		20	0.0	100.0			100.0	SD	0.0	0.0		0.0	0.0			0.0
11	29	0422G	SD-101	4		20	0		20		20	0.0	100.0			100.0	n	5	5		5	5			5
12	47	0422G	SD-101	5		20	0		20		20	0.0	100.0			100.0									
13	43	0422G	SD-101	6	wq repl	20																			
14	36	0422G	SD-101	7	day0 bkr																				
15	46	0423G	SD-102	1		20	0		20		20	0.0	100.0			100.0									
16	23	0423G	SD-102	2		20	0		20		20	0.0	100.0			100.0	Mean	0.0	20.0		0.0	100.0			100.0
17	34	0423G	SD-102	3		20	0		20		20	0.0	100.0			100.0	SD	0.0	0.0		0.0	0.0			0.0
18	6	0423G	SD-102	4		20	0		20		20	0.0	100.0			100.0	n	5	5		5	5			5
19	25	0423G	SD-102	5		20	0		20		20	0.0	100.0			100.0									
20	38	0423G	SD-102	6	wq repl	20																			
21	4	0423G	SD-102	7	day0 bkr																				
22	19	0424G	SD-103	1		20	8	8	12	0	12	40.0	60.0	100.0	0.0	60.0									
23	51	0424G	SD-103	2		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
24	18	0424G	SD-103	3		20	5	5	15	0	15	25.0	75.0	100.0	0.0	75.0	SD	1.6	1.6	0.0	8.2	8.2	0.0	0.0	8.2
25	52	0424G	SD-103	4		20	8	8	12	0	12	40.0	60.0	100.0	0.0	60.0	n	5	5	5	5	5	5	5	5
26	11	0424G	SD-103	5		20	9	9	11	0	11	45.0	55.0	100.0	0.0	55.0									
27	5	0424G	SD-103	6	wq repl	20																			
28	44	0424G	SD-103	7	day0 bkr																				
29	39	0425G	SD-104	1		20	14	14	6	0	6	70.0	30.0	100.0	0.0	30.0									
30	20	0425G	SD-104	2		20	14	14	6	0	6	70.0	30.0	100.0	0.0	30.0	Mean	15.2	4.8	0.0	76.0	24.0	100.0	0.0	24.0
31	33	0425G	SD-104	3		20	15	15	5	0	5	75.0	25.0	100.0	0.0	25.0	SD	1.3	1.3	0.0	6.5	6.5	0.0	0.0	6.5
32	15	0425G	SD-104	4		20	16	16	4	0	4	80.0	20.0	100.0	0.0	20.0	n	5	5	5	5	5	5	5	5
33	31	0425G	SD-104	5		20	17	17	3	0	3	85.0	15.0	100.0	0.0	15.0									
34	9	0425G	SD-104	6	wq repl	20																			
35	50	0425G	SD-104	7	day0 bkr																				
36	1	0426G	REF-EBB	1		20	11	11	9	0	9	55.0	45.0	100.0	0.0	45.0									
37	26	0426G	REF-EBB	2		20	17	17	3	0	3	85.0	15.0	100.0	0.0	15.0	Mean	15.4	4.6	0.0	77.0	23.0	100.0	0.0	23.0
38	37	0426G	REF-EBB	3		20											SD	2.7	2.7	0.0	13.5	13.5	0.0	0.0	13.5

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL		INIT	SURV	REBUR	MORT	NO-BURY	TEM	PSURV	PMORT	PBURY	PNO-BURY	PTEM
39	42	0426G	REF-EBB	4		20	15	15	5	0	5	75.0	25.0	100.0	0.0	25.0
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	wq repl	20	16	16	4	0	4	80.0	20.0	100.0	0.0	20.0
42	30	0426G	REF-EBB	7	day0 bkr											
43	56	0427G	REF-YB	1		20	9	9	11	0	11	45.0	55.0	100.0	0.0	55.0
44	17	0427G	REF-YB	2		20	8	8	12	0	12	40.0	60.0	100.0	0.0	60.0
45	16	0427G	REF-YB	3		20	7	7	13	0	13	35.0	65.0	100.0	0.0	65.0
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	wq repl	20										
49	32	0427G	REF-YB	7	day0 bkr											
50	35	0438G	control	1		20	20	20	0	0	0	100.0	0.0	100.0	0.0	0.0
51	24	0438G	control	2		20	19	19	1	0	1	95.0	5.0	100.0	0.0	5.0
52	2	0438G	control	3		20	20	20	0	0	0	100.0	0.0	100.0	0.0	0.0
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	wq repl	20										
56	40	0438G	control	7	day0 bkr											

	SURV	MORT	NO-BURY	PSURV	PMORT	PBURY	PNO-BURY	PTEM
n	5	5	5	5	5	5	5	5
Mean	7.8	12.2	0.0	39.0	61.0	100.0	0.0	61.0
SD	1.3	1.3	0.0	6.5	6.5	0.0	0.0	6.5
n	5	5	5	5	5	5	5	5
Mean	19.8	0.2	0.0	99.0	1.0	100.0	0.0	1.0
SD	0.4	0.4	0.0	2.2	2.2	0.0	0.0	2.2
n	5	5	5	5	5	5	5	5

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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:

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

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	No

Test Results:

Statistic:	Approximate t
Balanced Design:	Yes
Transformation:	Rankits

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	4
Experimental Alpha Level:	0.05
Calculated Value:	5.9677
Critical Value:	>= 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	Shipiro-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	

MSR 6-5-06

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.

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:

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

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	No

Test Results:

Statistic:	Approximate t
Balanced Design:	Yes
Transformation:	Rankits

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	4
Experimental Alpha Level:	0.05
Calculated Value:	5.9677
Critical Value:	>= 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	Shipiro-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	

ysr 6-5-06

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.

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:

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

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	No

Test Results:

Statistic:	Approximate t
Balanced Design:	Yes
Transformation:	Rankits

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	4
Experimental Alpha Level:	0.05
Calculated Value:	5.9677
Critical Value:	>= 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	Shipiro-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	

MSR 6-5-06

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	5.0974
Critical Value:	>= 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	Shipiro-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

mlr 6-5-06

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.

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.2602
Critical Value:	>= 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	Shipiro-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

YSR 6-5-06

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.

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	
5	55	0421G	SD-100	5	4	4	
5	55	0421G	SD-100	5	5	8	
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	

Mean	66.2
SD	20.2
n	5

Data entry verified against laboratory bench sheets MSR 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		

Test No.738-1

Marine Amphipod Test

Data entry verified against laboratory bench sheets - MLR 3/16/06

Water Quality Data

					Overlying water									Interstitial							assumed interstitial
BKR	NAS SMPL	CLIENT DESCRIP	REPL	DAY	TEMP	pH	SAL	DO	S	< or >	NH4+NH3	< or >	NH3	pH	SAL	S	< or >	NH4+NH3	< or >	NH3	temp.
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														

	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													

Test No.738-1

Marine Amphipod Test

	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.
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

Kennedy/Jenks Consultants

Possible Hazards

Client: EnviroLogic Resources
Site: Astoria Area-Wide
Project No.: 0592004.00
Sampler Name: Tom Pinit / Cindy Ryals
Telephone: 503-295-4911

Report to: Taku Fuji
Company: Kennedy/Jenks
Address: 200 SW Market St. #500 Portland, OR 97201
Fax: 503-295-4901

Lab Destination: Northwestern Aquatic Sciences
Address: 3814 Yaquina Bay Rd. Newport, OR 97365
Telephone: 541-265-7225
Carrier/Way Bill No.:

(1) Lab ID No.	(1) Client ID No.	Collection Date	Collection Time	(2) Type	Depth	(3) Comp.	(4) Pres.	Turn-around	(5) Analyses Requested	Comment/Conditions (container type, container number, etc.)
	SD-100	1/26/06	1145	S		0421G	UASF		Measure interstitial ammonia & sulfide upon receipt Hold until further directed (awaiting chemical analyses)	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				Reference
	REF-EBB		1630	S		0426G				Reference
	REF-YB		1510	S		0427G				
										jars were full (no head space)
										cooler Temperatures: 1.5°C, 3.0°C, 2.0°C

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(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 Relinquished By					Sample Received By				
Print Name	Signature	Company	Date	Time	Print Name	Signature	Company	Date	Time
P. THOMAS PINIT	P. Jed/C6	K/J	1/27/06	1240	Michele S. Redmond	Michele S. Redmond	NAS	1-27-06	13:45

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REFERENCE TOXICANT RESULTS AND ANALYSIS

NORTHWESTERN AQUATIC SCIENCES

PROTOCOL NO. NAS-XXX-RA1

ACUTE TOXICITY TEST (ALL SPECIES)

reviewed

Test No. 999- 2085 Client: QC Test Investigator pgp 1-6 MSR 3-16-06

Test Type (rangefinding/definitive) definitive Test Length (hr) 48

Species *Eohaustorius estuarius*

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 MSR

QA Officer L.K. Nemeth

1. G.J. IRISSARRI GJI 2. Greg Hutchinson GH

3. 4.

5. 6.

Study Schedule:

Test Beginning: 2-17-06 11:15 Test 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 water

Date of Preparation/Collection: 2-15-06

Water Quality: Salinity (ppt) 28.0 pH

Treatments: Filtered to 0.4 µm, 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	ø	60	30	240				
A	60	240	30	15	120	ø				

Error codes: 1) Corrrection 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 PROTOCOL NO. NAS-XXX-RA1

ACUTE TOXICITY TEST (ALL SPECIES)

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 amount	Feeding description	Water changes	Comments
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

Beaker placement: Stratified randomization

Test temperature (deg.C): 15.0 +/- 1.0

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	

6.32 2-17-06

Light intensity measurements: Date Location foot-candles

NORTHWESTERN AQUATIC SCIENCES
ACUTE TOXICITY TEST (ALL SPECIES)

PROTOCOL NO. NAS-XXX-RA1

Test No. 999-2085 Client QC Test Investigator _____

DAILY RECORD SHEET

Day 0 (2/17/06) GH / MSR

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors A	Survivors 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) GSI

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors A	Survivors B
1. 240	15.5	7.6	28.0	6.6	∅ (1D)	∅ (1D)
2. 120	15.4	7.8	28.0	7.6	∅ (1D)	∅ (1D)
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) GSI

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors A	Survivors B
1. 240	—	—	—	—	∅	∅
2. 120	—	—	—	—	∅	∅
3. 60	15.0	7.8	28.0	7.3	8 (2D)	8 (2D)
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:	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)
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-Karber

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	

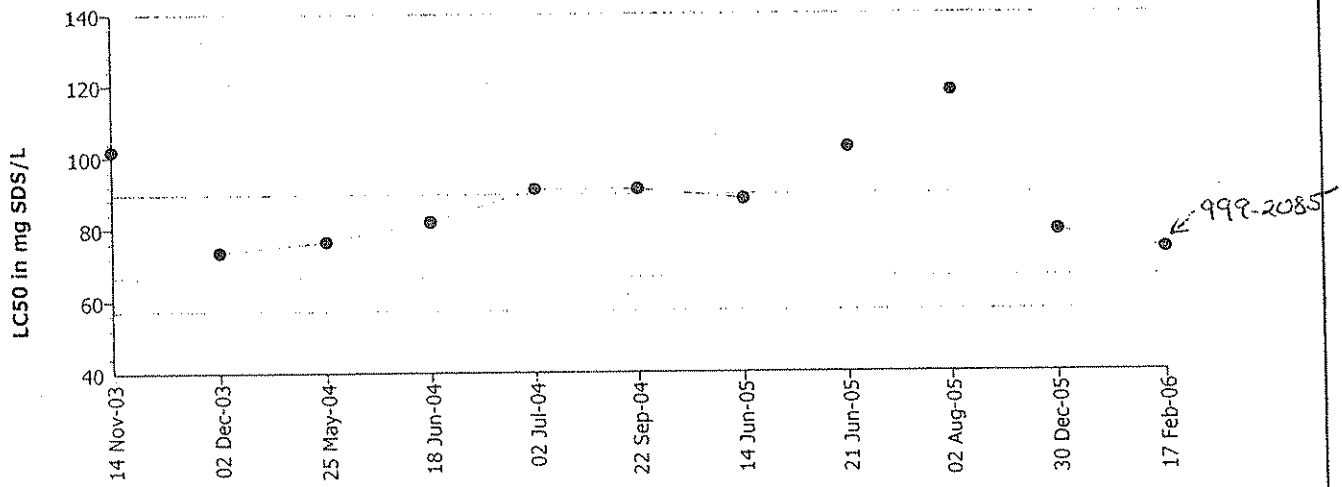
Data entry verified against laboratory bench sheets.
MLR
2-28-06

CETIS QC Chart

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

YNR
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 ≤0.40 µm, 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 ± 3.9°C; pH, 7.6 ± 0.5; salinity, 30.8 ± 2.8 ‰; dissolved oxygen, 7.4 ± 0.5 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 ≤10% and a growth rate of >0.38 mg/individual/day.
Performance Criteria: For DMMP and SMS testing, the reference sediment mortality should be ≤20% with a growth rate of ≥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 x (no. of surviving worms/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 ± 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 $CdCl_2 \cdot 2½H_2O$, 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: $CdCl_2 \cdot 2½H_2O$, 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 (≥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 ≤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 ≥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 J. 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 ± SD	Minimum	Maximum	N
Temperature (°C)	19.9 ± 0.5	19.0	21.0	64
pH	7.7 ± 0.1	7.3	7.9	64
Salinity (‰)	28.2 ± 1.5	25.0	30.0	64
Dissolved Oxygen (mg/L)	6.8 ± 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 ± 0.0	21.3 ± 5.2	1.03 ± 0.26
REF-EBB (NAS #0426G) [1]	100.0 ± 0.0	16.5 ± 2.3	0.79 ± 0.12
REF-YB (NAS #0427G) [1]	100.0 ± 0.0	22.6 ± 3.3	1.09 ± 0.17
SD-100 (NAS #0421G)	100.0 ± 0.0	15.6 ± 1.6	0.74 ± 0.08
SD-101 (NAS #0422G)	100.0 ± 0.0	16.5 ± 2.3	0.79 ± 0.12
SD-102 (NAS #0423G)	96.0 ± 8.9	17.3 ± 2.2	0.83 ± 0.11
SD-103 (NAS #0424G)	100.0 ± 0.0	15.3 ± 3.3	0.73 ± 0.17
SD-104 (NAS #0425G)	100.0 ± 0.0	16.8 ± 2.2	0.80 ± 0.11

[1] 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 ± 0.26	---	---	---	---	---
REF-EBB (NAS #0426G) [1]	0.79 ± 0.12	---	76.7	---	---	---
REF-YB (NAS #0427G) [1]	1.09 ± 0.17	---	106	---	---	---
SD-100 (NAS #0421G)	0.74 ± 0.08	NO	71.8	93.7	NO	NO
SD-101 (NAS #0422G)	0.79 ± 0.12	NO	76.7	100	NO	NO
SD-102 (NAS #0423G)	0.83 ± 0.11	NO	80.6	105	NO	NO
SD-103 (NAS #0424G)	0.73 ± 0.17	NO	70.9	92.4	NO	NO
SD-104 (NAS #0425G)	0.80 ± 0.11	NO	77.7	101	NO	NO

[1] 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 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 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 ± 1°C, and the salinity is adjusted to 28 ± 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 ≥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°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® 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 ± 1°C. The test salinity is 28 ± 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 ± 2 ppt test water that has been maintained at 20 ± 1 °C. Care should be taken not to disturb the sediments.

7.6 Feeding: Animals are fed 40 mg TetraMarine® 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
Biological Data	
Survival	end of test
Biomass	end of test
Physical and Chemical Data	
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^{2-} (Standard Methods 1995 [19th 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

_____ for _____
Name Date

_____ for **NORTHWESTERN AQUATIC SCIENCES**
Name Date

APPENDIX II

RAW DATA

TEST DESCRIPTION, MONITORING, AND RESULTS BENCHSHEETS

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4
NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST
renewed

Test No. 738-2 Client Kennedy/Jenks Investigator PBR 1-41 MSR 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 MSR

QA Officer L.K. Nemeth

1. Bill Montgomery WM
2. GABrown GB
3. Susan Sage SS
4. Greg Hutchinson GH
5. R.S. Caldwell
6. G.S. IRISSARRI GSI
7.
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):					

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 PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

SEDIMENT DESCRIPTIONS -- SUPPLEMENTAL NOTES

Sample No.	Description
0421G	black mud w/ woody & grassy debris; petroleum smell
0422G	black mud w/ chunks of wood
0423G	dark brown mud w/ fibrous material & sticks; petroleum smell
0424G	black mud w/ woody debris
0425G	black sticky mud
0426G	black sticky mud
0427G	black sticky mud w/ some sand
0438G	brown sand
	After sediment was added to beakers, and overlying water added to the 750mL mark on 2-22-05, sediment was stirred with the overlying water and allowed to settle overnight with aeration MSR

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

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 µm, 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 amount	Feeding description	Water changes	Comments
2-21-06	13.8	7.0	34.0	7.6	0.1g/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	0.1g/tank	Tetramarine		
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

Feeding: every other day beginning with day zero

Test temperature (deg.C): 20.0 +/- 1.0

Beaker placement: Total randomization

Photoperiod: Constant light

Salinity: 28 +/- 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	Location in room	foot-candles
2-24-06	watchglass, beaker #20	24.4

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4
NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-1 Client Kennedy/Jenks Investigator _____

Test conducted in (circle one): room 1 room 2 (trailer) water bath other:_____

Randomization chart: wall

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		
Record WQ	x			x			x			x			x			x			x		x
Change water				x			x			x			x			x			x		
Overlying NH4,S	x			NH3																	x
Initials	MSR	GH	MSR	MSR	AJ	GH	MSR	MSR	MSR	AJ	GH	GH	AJ	MSR	GH	MSR	AJ	GH	GH	AJ	GA
Porewater NH4, ppt, pH																					ppt only
Initials																					

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 0 (2 123 106) mm/MLR Temperature beaker: 21.0 deg.C

air okay? (if not, details in comments below) All OK
water change? (every third day) —
fed? (every second day) yes

overlying ammonia sampled? yes
(days 0,3,20)
overlying sulfide sampled? yes
(days 0, 20)

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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 0 (2 /23 /06) mm/mdd

Temperature beaker: _____ deg.C

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	No. not buried	Comments
41					0	
42					0	
43					0	
44					0	
45					0	
46					0	
* 47	21.0	7.7	25.0	6.9	0	
* 48	20.7	7.7	25.5	6.9	0	

* Water quality beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 1 (2/24/96) MB Temperature beaker: 20.6 deg.C

air okay? (if not, details in comments below) yes

water change? (every third day) —

fed? (every second day) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

Day 2 (2/25/96) MB/MSR Temperature beaker: 20.6 deg.C

air okay? (if not, details in comments below) yes

water change? (every third day) —

fed? (every second day) yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 3 (2/26/06 JM Temperature beaker: 20.6 deg.C

air okay? (if not, details in comments below) yes
water change? (every third day) yes
fed? (every second day) —
overlying NH3 sampled (days 0,3,20)? yes
~~overlying S sampled (days 0,20)?~~ MLR 2-13-06

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3	20.7	7.4	27.0	7.0	
5	20.5	7.8	27.0	6.8	
11	20.3	7.8	26.5	6.6	
26	20.1	7.9	26.0	6.4	
31	20.6	7.7	27.0	7.1	
33	20.1	7.9	27.0	6.6	
47	20.0	7.7	26.5	6.9	
48	20.2	7.7	27.0	6.8	

Day 4 (2/27/06 AJ Temperature beaker: 20.3 deg.C

air okay? (if not, details in comments below) yes
water change? (every third day) _____
fed? (every second day) yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 5 (2/28/06) GH 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) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

Day 6 (3/1/06) Temperature beaker: 20.1 deg.C

air okay? (if not, details in comments below) All OK
water change? (every third day) yes
fed? (every second day) yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3	20.5	7.3	27.5	6.2	
5	20.2	7.8	28.5	7.0	
11	20.1	7.8	28.0	6.4	
26	19.7	7.8	29.0	7.0	
31	20.1	7.8	27.5	6.6	
33	19.8	7.8	28.0	7.0	
47	20.1	7.8	27.0	6.7	
48	20.1	7.7	27.0	6.8	

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 7 (3/12/06) wtr 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) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

Day 8 (3/13/06) wtr 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) yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

NORTHWESTERN AQUATIC SCIENCES
NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

PROTOCOL NO. NAS-XXX-NA4

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) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3	20.0	7.5	27.5	5.9	
5	19.9	7.8	29.0	7.1	
11	19.7	7.8	28.0	6.6	
26	19.5	7.8	28.5	7.1	
31	19.9	7.7	28.0	6.3	
33	19.3	7.8	28.5	7.1	
47	19.8	7.9	28.0	6.6	
48	19.7	7.7	27.5	6.8	

Day 10 (3/5/06) GJ 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

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator [redacted]

DAILY RECORD SHEET

Day 11 (3 16 06) 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) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

Day 12 (3 17 06) mm/dd

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

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3	20.2	7.5	29.0	5.4	
5	19.9	7.8	30.0	6.6	
11	19.7	7.8	30.0	6.2	
26	19.6	7.8	30.0	6.7	
31	19.9	7.7	30.0	5.9	
33	19.7	7.8	30.0	6.3	
47	19.8	7.8	29.5	6.4	
48	19.8	7.8	29.0	6.2	

NORTHWESTERN AQUATIC SCIENCES
NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

PROTOCOL NO. NAS-XXX-NA4

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 13 (3/18/06) MM Temperature beaker: 19.6 deg.C

air okay? (if not, details in comments below) All OK
water change? (every third day) —
fed? (every second day) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

Day 14 (3/19/06) GH 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) yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 15 (3 / 10 / 06) B/room Temperature beaker: 19.6 deg.C

air okay? (if not, details in comments below) yes
water change? (every third day) yes
fed? (every second day) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3	20.1	7.4	28.5	6.0	
5	19.5	7.8	29.0	7.2	
11	19.6	7.8	28.0	6.9	
26	19.4	7.8	29.0	6.7	
31	19.6	7.7	27.0	7.0	
33	19.3	7.8	28.0	7.1	
47	19.6	7.8	28.5	6.8	
48	19.6	7.8	27.0	7.0	

Day 16 (3 / 11 / 06) B / A 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

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 17 (3/12/06) GH

Temperature beaker: 19.4 deg.C

air okay? (if not, details in comments below) YES
water change? (every third day) L
fed? (every second day) —

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3					
5					
11					
26					
31					
33					
47					
48					

Day 18 (3/13/06) GH/DS

Temperature beaker: 19.5 deg.C

air okay? (if not, details in comments below) NO
water change? (every third day) yes
fed? (every second day) yes

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3	19.6	7.7	30.0	7.0	All OK except #24 Air Pipet
5	19.6	7.8	30.0	7.4	Clogged with Salt, New pipet installed
11	19.6	7.8	30.0	7.0	GH
26	19.4	7.8	30.0	7.4	
31	19.5	7.6	28.0	7.0	
33	19.0	7.9	29.0	7.2	
47	19.7	7.7	30.0	7.2	
48	19.1	7.8	29.0	7.0	

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

DAILY RECORD SHEET

Day 19 | 3 | 14 | 06 | GH

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) —

Beaker No.	Temp. (deg.C)	pH @ GH 3-15-06	Sal. (ppt)		DO (ppm)	Comments
3	~~7.5~~ 20.0	~~20~~ 7.5				
5						
11						
26						
31						
33						
47						
48						

Day 20 | 3 | 15 | 06 | GH

Temperature beaker: _____ deg.C

air okay? (if not, details in comments below) All ok

water change? (every third day) — overlying NH3 sampled (days 0,3,20)? _____

fed? (every second day) ~~—~~ MLR 2-13-06 overlying S sampled (days 0,20)? _____

Beaker No.	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Comments
3	20.0	7.5	30.0	6.8	
5	19.9	7.8	30.0	7.2	
11	19.8	7.7	30.0	6.8	
26	19.6	7.8	28.5	7.2	
31	19.6	7.6	30.0	6.8	
33	19.4	7.8	29.0	7.0	
47	20.0	7.7	30.0	7.0	
48	19.7	7.7	30.0	6.8	

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4
NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No 738-2 Client Kennedy/Jenks Investigator

DAY 10 TEST TERMINATION SHEET

Beaker No.	Interstitial Salinity	No. of survivors	Initial	Comment
1		5	MiR	
2		5	MiR	
3	32.0			
4		5	WTM	
5	32.0			
6		5	MiR	
7		5	WTM	
8		5	MiR	
9		5	MiR	
10		5	WTM	
11	31.0			
12		5	GJL	
13		5	WTM	
14		5	MiR	
15		5	GJL	
16		5	GJL	
17		5	WTM	
18		5	MiR	
19		5	GJL	
20		5	WTM	
21		5	GJL	
22		5	WTM	
23		5	GJL	
24		5	WTM	
25		5	WTM	
26	30.0			
27		5	VB	
28		5	GJL	
29		5	GJL	
30		5	VB	
31	30.0			
32		5	VB	
33	30.0		MiR 3-27-06**	
34		4	WTM	
35		5	VB	
36		5	GJL	
37		5	VB	
38		5	WTM	
39		5	VB	
40		5	GJL	

Beaker No.	Interstitial Salinity	No. of survivors	Initial	Comment
41		5	VB	
42		5	VB	
43		5	WTM	
44		5	GJL	
45		5	GJL	
46		5	VB	
47	30.5			
48	30.0			

* 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.

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 MSR
Standard Weights: 10 mg: 10.005 mg 100mg: 100.011 mg

Final: Date 2-24-06 Oven temp (C.) ~~10.005~~ 50 mlt 2-27-06 Drying time (hr.) 22 Initials MSR
Standard Weights: 10 mg: 10.003 100mg: 100.010

Equip. 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	

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-NA4

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.) 1½ 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) 1	2	3	no. weighed	put into pans-initials	Comments
1	1	89.66			214.87	5	MSR	
2	2	90.37			175.46	5	MSR	
3	3	—	—	—	—	—	—	
4	4	91.38			173.86	5	MSR	
5	5	—	—	—	—	—	—	
6	6	89.86			232.12	5	MSR	
7	7	94.23			179.65	5	MSR	
8	8	86.71			161.29	5	MSR	
9	9	90.58			163.65	5	MSR	
10	10	87.54			222.25	5	MSR	
11	11	—	—	—	—	—	—	
12	12	93.22			185.27	5	MSR	
13	13	88.92			179.76	5	MSR	
14	14	93.34			157.36	5	MSR	
15	15	96.07			221.04	5	MSR	
16	16	88.45			185.67	5	MSR	
17	17	91.12			159.30	5	MSR	
18	18	84.54			149.00	5	MSR	
19	19	87.49			194.80	5	MSR	
20	20	81.01			168.52	5	MSR	
21	21	92.02			183.72	5	MSR	
22	22	89.04			169.70	5	MSR	
~~24~~ 25	23	92.43	~~197.26~~ JF		170.05	5	MSR	
~~23~~ 24	24	91.86	197.26	196.91	195.87	5	MSR	
25	25	89.96	187.50	187.35	186.67	5	MSR	
26	26	—	—	—	—	—	—	
27	27	91.57	185.95	185.74	184.98	5	MSR	
28	28	84.47	180.43	180.23	179.52	5	MSR	
29	29	85.44	178.12	177.92	177.19	5	MSR	
30	30	77.27	144.39	144.25	143.85	5	MSR	
31	31	—	—	—	—	—	—	
32	32	82.76	169.40	169.22	168.67	5	MSR	
33	33	—	—	—	—	—	—	

* Water quality beakers

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-NA4

NEANTHES SP. 20-DAY SOLID PHASE SEDIMENT TEST

Test No. 738-2 Client Kennedy/Jenks Investigator _____

WEIGHING DATA SHEET

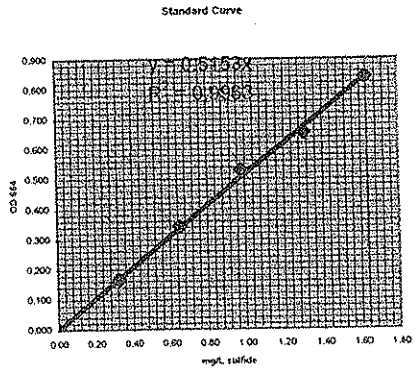
See page 19 for information on drying times and temperatures, standard weights,etc.

Bkr. #	Pan #	Tare wt. (mg)	Total wt. (mg) 1	2	3	no. weighed	put into pans-initials	Comments
34	34	84.24	158.73	158.56	157.99	4	MSR	one worm broken in two
35	35	85.10		~~158.00~~ JF	158.00	5	MSR	
36	36	91.25			171.53	5	MSR	
37	37	85.84			172.56	5	MSR	
38	38	97.01			164.91	5	MSR	
39	39	84.44			179.64	5	MSR	
40	40	85.39			179.37	5	MSR	
41	41	87.33			152.24	5	MSR	
42	42	91.77			157.43	5	MSR	
43	43	90.74			192.34	5	MSR	
44	44	87.50			168.33	5	MSR	
45	45	91.54			166.86	5	MSR	
46	46	86.65			171.99	5	MSR	
47	47	—	—	—	—	—	—	
48	48	—	—	—	—	—	—	

* 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
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28				
29.				
30.				
31.				
32.				
33.				
34.				
35.				
36.				

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

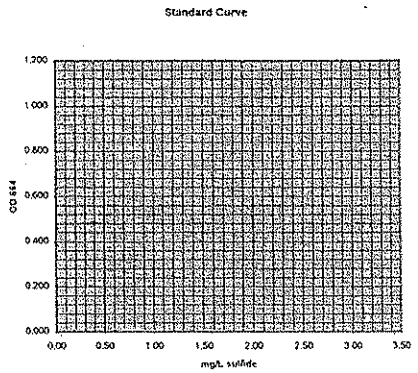
Analyst:	RSC
Date analysed:	2/23/2006

Dissolved Sulfide in Water: Computation Worksheet
Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	95	120	95
Working Std. Conc. (mg/L):		3.2	

Result

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.	-----	.538	3.20
3.0 mL spike	-----	.527	
3.0 mL spike dupl.	-----	.515	



1.	3	5	.000
2.	5	5	.000
3.	11	5	.004
4.	26	5	.001
5.	31	5	.004
6.	33	5	.000
7.	47	5	.002
8.	48	5	.002
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			
26.			
27.			
28			
29.			
30.			
31.			
32.			
33.			
34.			
35.			
36.			

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

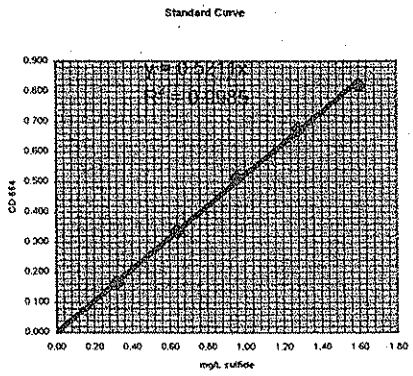
Analyst:	RSC
Date analysed:	2/23/2006

Dissolved Sulfide in Water: Computation Worksheet
Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	97	102	101
Working Std. Conc. (mg/L):		1.6	

Result

	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



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

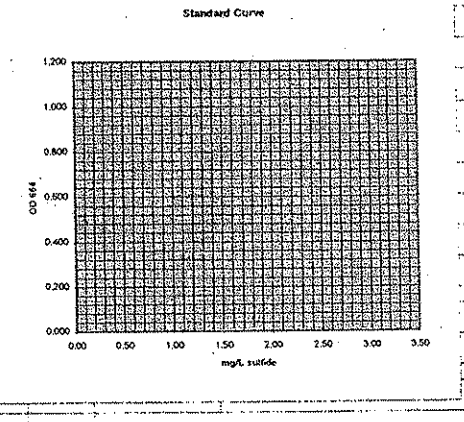
Analyst: RSC
Date analysed: 3/16/2005

Dissolved Sulfide in Water: Computation Worksheet
Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAC titrant employed:	97	102	101
Working Std. Conc. (mg/L):		3.2	

Result

	Sample description	Dilution factor	OD664	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	.000	
3.	11	5	.002	
4.	26	5	.007	
5.	31	5	.000	
6.	33	5	.002	
7.	47	5	.004	
8.	48	5	.003	
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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.: 738-2
Test Day: 20 (3-15-06)
Species: *Neanthes*

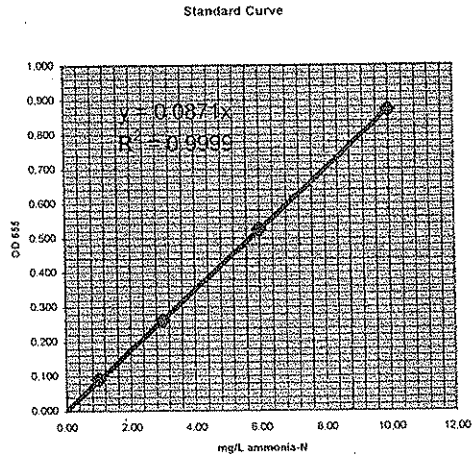
overlying water

Analyst: RSC
Date analysed: 3/16/2005

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	-----	-----	-----
	1.0 mg/L NH_3-N Std.	-----	0.091	1.00
	3.0 mg/L NH_3-N Std.	-----	0.260	3.00
	6.0 mg/L NH_3-N Std.	-----	0.525	6.00
	10.0 mg/L NH_3-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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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

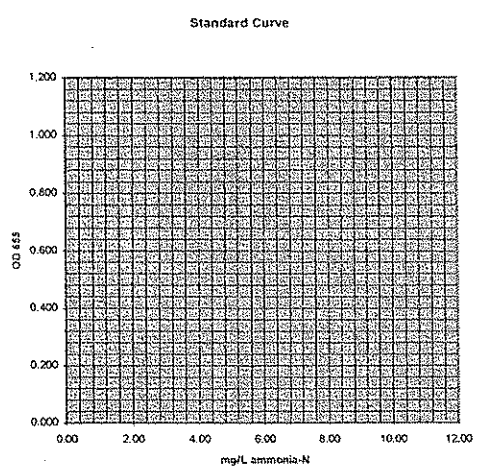
Analyst: RSC
Date analysed: 2/23/2006

Total Ammonia-N in Water: Computation Worksheet

Salicylate Method (SOP #5492)

Result

	Sample description		Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank		-----	-----	-----
	1.0 mg/L NH_3-N Std.		-----	.091	1.00
	3.0 mg/L NH_3-N Std.		-----	.260	3.00
	6.0 mg/L NH_3-N Std.		-----	.525	6.00
	10.0 mg/L NH_3-N Std.		-----	.970	10.00
	3.0 mg/L spike		-----	.270	
	3.0 mg/L spike dupl.		-----	.278	
	5.0 mg/L 2nd source		-----	.433	
1.	3		1	.135	
2.	5		1	.327	
3.	11		1	.312	
4.	26		1	.017	
5.	31		1	.248	
6.	33		1	.312	
7.	47		1	.401	
8.	48		1	.189	



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*

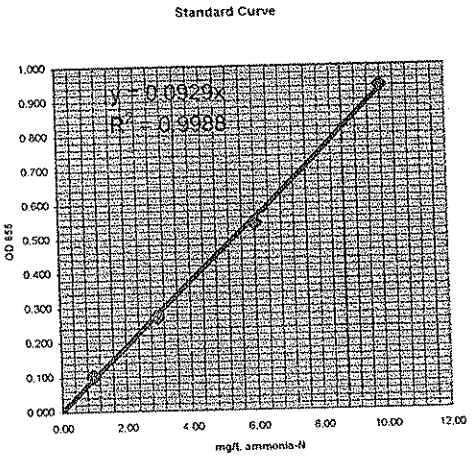
Overlying water

Analyst: RSC
Date analysed: 2/23/2006

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	-----	-----	-----
	1.0 mg/L NH_3-N Std.	-----	0.102	1.00
	3.0 mg/L NH_3-N Std.	-----	0.272	3.00
	6.0 mg/L NH_3-N Std.	-----	0.542	6.00
	10.0 mg/L NH_3-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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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: *Nearithes*

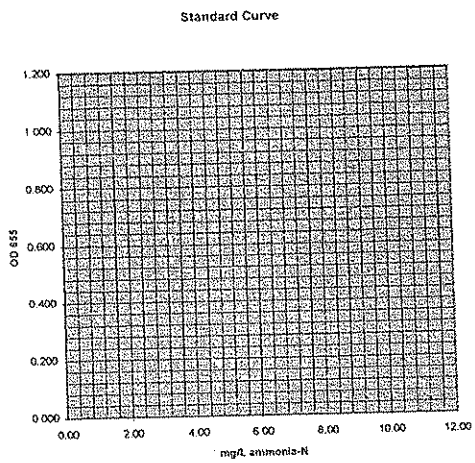
Overlying water

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_3-N (mg/L)
	Blank	----	----	----
	1.0 mg/L NH_3-N Std.	----	.102	1.00
	3.0 mg/L NH_3-N Std.	----	.272	3.00
	6.0 mg/L NH_3-N Std.	----	.542	6.00
	10.0 mg/L NH_3-N Std.	----	.940	10.00
	3.0 mg/L spike	----	.258	
	3.0 mg/L spike dupl.	----	.293	
	5.0 mg/L 2nd source	----	.442	
1.	3	1	.250	
2.	5	1	.638	
3.	11	1	.585	
4.	26	1	.176	
5.	31	1	.519	
6.	33	1	.620	
7.	47	1	.695	
8.	48	1	.969	
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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*

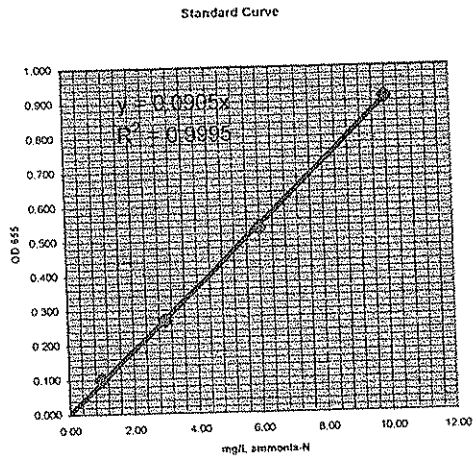
Overlying water

Analyst: RSC
Date analysed: 2/27/2006

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description		Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank		-----	----	----
	1.0 mg/L NH_3-N Std.		-----	0.100	1.00
	3.0 mg/L NH_3-N Std.		-----	0.270	3.00
	6.0 mg/L NH_3-N Std.		-----	0.535	6.00
	10.0 mg/L NH_3-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
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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*

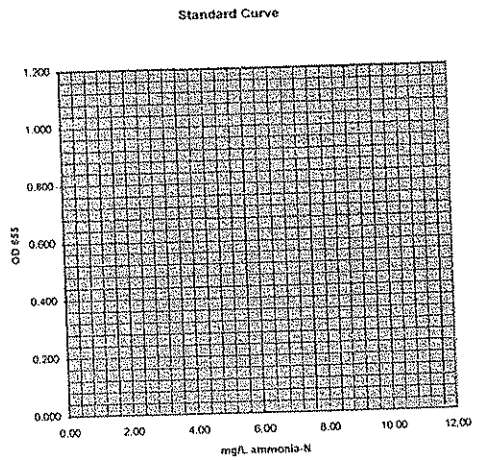
Overlying water

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_3-N (mg/L)
	Blank	----	----	----
	1.0 mg/L NH_3-N Std.	----	.100	1.00
	3.0 mg/L NH_3-N Std.	----	.270	3.00
	6.0 mg/L NH_3-N Std.	----	.535	6.00
	10.0 mg/L NH_3-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	.075	
3.	11	1	.046	
4.	26	1	.020	
5.	31	1	.028	
6.	33	1	.027	
7.	47	1	.037	
8.	48	1	.348	
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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: 20 (3-15-06)
Species: *Neanthes*

Overlying water

Analyst: RSC
Date analysed: 3/16/2006

TEST DATA ANALYSIS RECORDS

Test no. 738-2

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

Neanthes Growth Test

Test no. 738-2

Endpoints Data Entry and Calculations File

BKR=beaker number (=pan number)
INIT NO.=initial number of worms exposed
FINAL 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
FINAL WT=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

INIT WT

pan#	tare wt	total wt	# weighed	individual wt
4	45.93	49.55	5	0.72
5	46.74	50.25	5	0.70
6	51.92	55.86	5	0.79
			MEAN	0.74

Data entry verified against laboratory bench sheets - MER 3-27-06

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL		INIT NO.	FINAL IW PPT	SURV	MORT	INIT WT	TARE WT	WT COUNT	FINAL WT	PSURV	PMORT	TWT	WT	GR
1	37	0421G	SD-100	1		5		5	0	0.74	85.84	5	172.56	100.0	0.0	86.7	17.3	0.83
2	42	0421G	SD-100	2		5		5	0	0.74	91.77	5	157.43	100.0	0.0	65.7	13.1	0.62
3	36	0421G	SD-100	3		5		5	0	0.74	91.25	5	171.53	100.0	0.0	80.3	16.1	0.77
4	4	0421G	SD-100	4		5		5	0	0.74	91.38	5	173.86	100.0	0.0	82.5	16.5	0.79
5	45	0421G	SD-100	5		5		5	0	0.74	91.54	5	166.86	100.0	0.0	75.3	15.1	0.72
6	48	0421G	SD-100	6	wq replicate	5	30.0											
7	17	0422G	SD-101	1		5		5	0	0.74	91.12	5	159.30	100.0	0.0	68.2	13.6	0.64
8	13	0422G	SD-101	2		5		5	0	0.74	88.92	5	179.76	100.0	0.0	90.8	18.2	0.87
9	9	0422G	SD-101	3		5		5	0	0.74	90.58	5	163.65	100.0	0.0	73.1	14.6	0.69
10	39	0422G	SD-101	4		5		5	0	0.74	84.44	5	179.64	100.0	0.0	95.2	19.0	0.92
11	2	0422G	SD-101	5		5		5	0	0.74	90.37	5	175.46	100.0	0.0	85.1	17.0	0.81
12	5	0422G	SD-101	6	wq replicate	5	32.0											
13	40	0423G	SD-102	1		5		5	0	0.74	85.39	5	179.37	100.0	0.0	94.0	18.8	0.90
14	38	0423G	SD-102	2		5		5	0	0.74	97.01	5	164.91	100.0	0.0	67.9	13.6	0.64
15	32	0423G	SD-102	3		5		5	0	0.74	82.76	5	168.67	100.0	0.0	85.9	17.2	0.82
16	34	0423G	SD-102	4		5		4	1	0.74	84.24	4	157.99	80.0	20.0	73.8	18.4	0.88
17	12	0423G	SD-102	5		5		5	0	0.74	93.22	5	185.27	100.0	0.0	92.1	18.4	0.88
18	3	0423G	SD-102	6	wq replicate	5	32.0											
19	29	0424G	SD-103	1		5		5	0	0.74	85.44	5	177.19	100.0	0.0	91.8	18.4	0.88
20	14	0424G	SD-103	2		5		5	0	0.74	93.34	5	157.36	100.0	0.0	64.0	12.8	0.60
21	16	0424G	SD-103	3		5		5	0	0.74	88.45	5	185.87	100.0	0.0	97.4	19.5	0.94
22	41	0424G	SD-103	4		5		5	0	0.74	87.33	5	152.24	100.0	0.0	64.9	13.0	0.61
23	18	0424G	SD-103	5		5		5	0	0.74	84.54	5	149.00	100.0	0.0	64.5	12.9	0.61
24	47	0424G	SD-103	6	wq replicate	5	30.5											
25	22	0425G	SD-104	1		5		5	0	0.74	89.04	5	169.70	100.0	0.0	80.7	16.1	0.77
26	30	0425G	SD-104	2		5		5	0	0.74	77.27	5	143.85	100.0	0.0	66.6	13.3	0.63
27	28	0425G	SD-104	3		5		5	0	0.74	84.47	5	179.52	100.0	0.0	95.1	19.0	0.91
28	7	0425G	SD-104	4		5		5	0	0.74	94.23	5	179.65	100.0	0.0	85.4	17.1	0.82
29	21	0425G	SD-104	5		5		5	0	0.74	92.02	5	183.72	100.0	0.0	91.7	18.3	0.88
30	11	0425G	SD-104	6	wq replicate	5	31.0											
31	46	0426G	REF-EBB	1		5		5	0	0.74	86.65	5	171.99	100.0	0.0	85.3	17.1	0.82
32	35	0426G	REF-EBB	2		5		5	0	0.74	85.10	5	158.00	100.0	0.0	72.9	14.6	0.69
33	43	0426G	REF-EBB	3		5		5	0	0.74	90.74	5	192.34	100.0	0.0	101.6	20.3	0.98
34	24	0426G	REF-EBB	4		5		5	0	0.74	92.43	5	170.05	100.0	0.0	77.6	15.5	0.74
35	8	0426G	REF-EBB	5		5		5	0	0.74	86.71	5	161.29	100.0	0.0	74.6	14.9	0.71
36	31	0426G	REF-EBB	6	wq replicate	5	30.0											

	TWT	WT	GR	PSURV	PMORT
Mean	78.1	15.6	0.74	100.0	0.0
S.D.	8.1	1.6	0.08	0.0	0.0
n	5	5	5	5	5
Mean	82.5	16.5	0.79	100.0	0.0
S.D.	11.5	2.3	0.12	0.0	0.0
n	5	5	5	5	5
Mean	82.7	17.3	0.83	96.0	4.0
S.D.	11.4	2.2	0.11	8.9	8.9
n	5	5	5	5	5
Mean	76.5	15.3	0.73	100.0	0.0
S.D.	16.6	3.3	0.17	0.0	0.0
n	5	5	5	5	5
Mean	83.9	16.8	0.80	100.0	0.0
S.D.	11.2	2.2	0.11	0.0	0.0
n	5	5	5	5	5
Mean	82.4	16.5	0.79	100.0	0.0
S.D.	11.7	2.3	0.12	0.0	0.0
n	5	5	5	5	5

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3/27/06

Neanthes Growth Test

Test no. 738-2

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL		INIT NO.	FINAL IW PPT	SURV	MORT	INIT WT	TARE WT	WT COUNT	FINAL WT	PSURV	PMORT	TWT	WT	GR		TWT	WT	GR	PSURV	PMORT
37	23	0427G	REF-YB	1		5		5	0	0.74	91.86	5	195.87	100.0	0.0	104.0	20.8	1.00						
38	10	0427G	REF-YB	2		5		5	0	0.74	87.54	5	222.25	100.0	0.0	134.7	26.9	1.31	Mean	112.9	22.6	1.09	100.0	0.0
39	1	0427G	REF-YB	3		5		5	0	0.74	89.66	5	214.87	100.0	0.0	125.2	25.0	1.22	S.D.	16.7	3.3	0.17	0.0	0.0
40	19	0427G	REF-YB	4		5		5	0	0.74	87.49	5	194.80	100.0	0.0	107.3	21.5	1.04	n	5	5	5	5	5
41	27	0427G	REF-YB	5		5		5	0	0.74	91.57	5	184.98	100.0	0.0	93.4	18.7	0.90						
42	33	0427G	REF-YB	6	wq replicate	5	30.0																	
43	6	0438G	control	1		5		5	0	0.74	89.86	5	232.12	100.0	0.0	142.3	28.5	1.39						
44	20	0438G	control	2		5		5	0	0.74	81.01	5	168.52	100.0	0.0	87.5	17.5	0.84	Mean	106.5	21.3	1.03	100.0	0.0
45	44	0438G	control	3		5		5	0	0.74	87.50	5	168.33	100.0	0.0	80.8	16.2	0.77	S.D.	26.2	5.2	0.26	0.0	0.0
46	15	0438G	control	4		5		5	0	0.74	96.07	5	221.04	100.0	0.0	125.0	25.0	1.21	n	5	5	5	5	5
47	25	0438G	control	5		5		5	0	0.74	89.96	5	186.67	100.0	0.0	96.7	19.3	0.93						
48	26	0438G	control	6	wq replicate	5	30.0																	

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	No Transformation

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.6559
Critical Value:	>= 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	Shipiro-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

YMH 6-5-06

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	No Transformation

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	0.0267
Critical Value:	>= 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	Shipiro-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

mer 6-5-06

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

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	No Transformation

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	-0.5046
Critical Value:	>= 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	Shipiro-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

MSR 6-5-06

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

BioStat Beta v.4.1(EXCEL)

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:

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:	<= 0.842
Normally Distributed:	No
Override Option:	Not Invoked

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Mann-Whitney
Balanced Design:	Yes
Transformation:	rank-order

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Mann-Whitney N1:	5
Mann-Whitney N2:	5
Degrees of Freedom:	
Experimental Alpha Level:	0.05
Calculated Value:	17
Critical Value:	>= 21.0
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	Shipiro-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

MSR 6-5-06

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	No Transformation

Experimental Hypothesis

Null:	x1 >= x2
Alternate:	x1 < x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.05
Calculated Value:	-0.1936
Critical Value:	>= 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	Shipiro-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

MLR 6-5-06

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

	NAS	CLIENT			Overlying water									
BKR	SMPL	DESCRIP	REPL	DAY	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			Data entry			
31	0426G	REF-EBB	6	6	20.1	7.8	27.5	6.6			verified against			
33	0427G	REF-YB	6	6	19.8	7.8	28.0	7.0			laboratory bench			
47	0424G	SD-103	6	6	20.1	7.8	27.0	6.7			sheets			
48	0421G	SD-100	6	6	20.1	7.7	27.0	6.8				MSR		
3	0423G	SD-102	6	9	20.0	7.5	27.5	5.9				3-27-06		
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						

	NAS	CLIENT			Overlying water								
BKR	SMPL	DESCRIP	REPL	DAY	TEMP	pH	SAL	DO	S	< or >	NH4+NH3	< or >	NH3
5	0422G	SD-101	6	18	19.6	7.8	30.0	7.4					
11	0425G	SD-104	6	18	19.6	7.8	30.0	7.0					
26	0438G	control	6	18	19.4	7.8	30.0	7.4					
31	0426G	REF-EBB	6	18	19.5	7.6	28.0	7.0					
33	0427G	REF-YB	6	18	19.0	7.9	29.0	7.2					
47	0424G	SD-103	6	18	19.7	7.7	30.0	7.2					
48	0421G	SD-100	6	18	19.1	7.8	29.0	7.0					
3	0423G	SD-102	6	20	20.0	7.5	30.0	6.8	<0.1		1.4		0.003
5	0422G	SD-101	6	20	19.9	7.8	30.0	7.2	<0.1		0.4		0.002
11	0425G	SD-104	6	20	19.8	7.7	30.0	6.8	<0.1		0.5		0.001
26	0438G	control	6	20	19.6	7.8	28.5	7.2	<0.1		0.2		0.001
31	0426G	REF-EBB	6	20	19.6	7.6	30.0	6.8	<0.1		0.3		0.001
33	0427G	REF-YB	6	20	19.4	7.8	29.0	7.0	<0.1		0.3		0.001
47	0424G	SD-103	6	20	20.0	7.7	30.0	7.0	<0.1		0.4		0.001
48	0421G	SD-100	6	20	19.7	7.7	30.0	6.8	<0.1		3.8		0.009
				Mean	19.9	7.7	28.2	6.8	---		---		---
				SD	0.5	0.1	1.5	0.4	---		---		---
				n	64	64	64	64	16		24		24
				Min	19.0	7.3	25.0	5.4	<0.1		0.2		0.004
				Max	21.0	7.9	30.0	7.4	<0.1		7.5		0.012

CHAIN-OF-CUSTODY RECORDS

Sample Chain-of-Custody/Analysis Request

Kennedy/Jenks Consultants

Possible Hazards

Client: Enviro Logic Resources
Site: Astoria Area-Wide
Project No.: 0592004.00
Sampler Name: Tom Pinit / Cindy Ryals
Telephone: 503-295-4911

Report to: Taku Fuji
Company: Kennedy / Jenks
Address: 200 SW Market. St. #500 Portland, OR 97201
Fax: 503-295-4901

Lab Destination: Northwestern Aquatic Sciences
Address: 3814 Yaquina Bay Rd. Newport, OR 97365
Telephone: 541-265-7225
Carrier/Way Bill No.:

(1) Lab ID No.	(1) Client ID No.	Collection Date	Collection Time	(2) Type	Depth	(3) Comp.	(4) Pres.	Turn-around	(5) Analyses Requested	Comment/Conditions (container type, container number, etc.)
	SD-100	1/26/06	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
										Jars were full (no head space)
										water temperatures: 1.5°C, 3.0°C, 2.0°C

14 of 14 page

(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 Relinquished By					Sample Received By				
Print Name	Signature	Company	Date	Time	Print Name	Signature	Company	Date	Time
P. THOMAS PINIT	P. Jenk	K/J	1/27/06	1240	Michele S. Redmond	Michele S. Redmond	NAS	1-27-06	13:45

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REFERENCE TOXICANT RESULTS AND ANALYSIS

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS- _____

ACUTE TOXICITY TEST (ALL SPECIES)

reviewed pp. 1-6 MSR 6-5-06

Test No. 999-2091 Client: QC Test Investigator pp. 1-6 MSR 6-5-06

Test Type (rangefinding/definitive) definitive Test Length (hr) 96

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 MSR

QA Officer L.K. Nemeth

1. Susan Gaff SG 2. Bill Montgomery WM
3. Greg Hutchinson GH 4.
5. 6.

Study Schedule:

Test Beginning: 2-28-06 11:30 Test Ending: 3-4-06 1030 hrs

TEST MATERIAL

Description: Cadmium as $CdCl_2$-2.5H2O, Aldrich Lot #12422KB, 1.0 mg/mL stock prepared:7-13-04

DILUTION WATER

Description: Yaquina Bay, Oregon, sea water

Date of Preparation/Collection: 2-21-06

Water Quality: Cond. (umhos/cm): ----- Salinity (ppt) 28.0 pH 8.0

Hardness (mg/L as $CaCO_3$): ------ Alkalinity (mg/L as $CaCO_3$): ------

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

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-_____

ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2091 Client QC Test Investigator _____

TEST ORGANISMS

Species: *Neanthes arenaceodentata* Age: _____ Size: 0.74 mg

Source: Dept. of Biology, CA State University, Long Beach, CA Date received: 2-21-06

Acclimation Data:

Date	Temp. (deg.C)	pH	Salinity (ppt)	DO (mg/L)	Feeding amount	Feeding description	Water changes	Comments
2-21-06	13.8	7.0	34.0	7.6	0.1g/tank	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	0.1g/tank	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 beaker Test volume: 100 mL

Replicates/treatment: 4 Organisms/treatment: 20 (5/replicate)

Test water changes: none Aeration during test: none

Feeding: none

Duration: 24-hr, 48-hr, (96-hr)

Beaker placement: Stratified randomization

Test temperature (deg.C): 20.0 +/- 1.0

Photoperiod: constant light

Test salinity (ppt): 28.0 +/- 2.0

MISCELLANEOUS NOTES

Test solution preparation:

mk 2-28-06

Concentration (mg/L)	mL of 1.0 mg/mL stock per 400 mL
25	10
12.5	5
6.25	2.5
3.13	1.25
1.56	0.62
0	0

Each concentration made up to 400 mL with dilution water and divided between four replicates

Light intensity measurements: Date Location foot-candles

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-_____

ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2091 Client QC Test Investigator _____

DAILY RECORD SHEET

Day 0 (2/28/06)GH

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) mw

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	Ø(5d)	Ø (5d)	Ø(5d)	Ø(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) mw

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors A	B	C	D
1. 25	–	–	–	–	Ø	Ø	Ø	Ø
2. 12.5	20.3	7.8	28.5	6.9	3(2d)	2(3d)	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 13 06) mw

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors A	B	C	D
1. 25	–	–	–	–	Ø	Ø	Ø	Ø
2. 12.5	20.4	7.8	29.0	7.2	Ø(3d)	1(1d)	Ø(6d)	Ø(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 14 06) SS

Conc. (mg/L)	Temp. (deg.C)	pH	Sal. (ppt)	DO (ppm)	Survivors A	B	C	D
1. 25	–	–	–	–	Ø	Ø	Ø	Ø
*2. 12.5	20.5	7.9	29.5	7.1	Ø	Ø(1d)	Ø	Ø
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-Karber

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

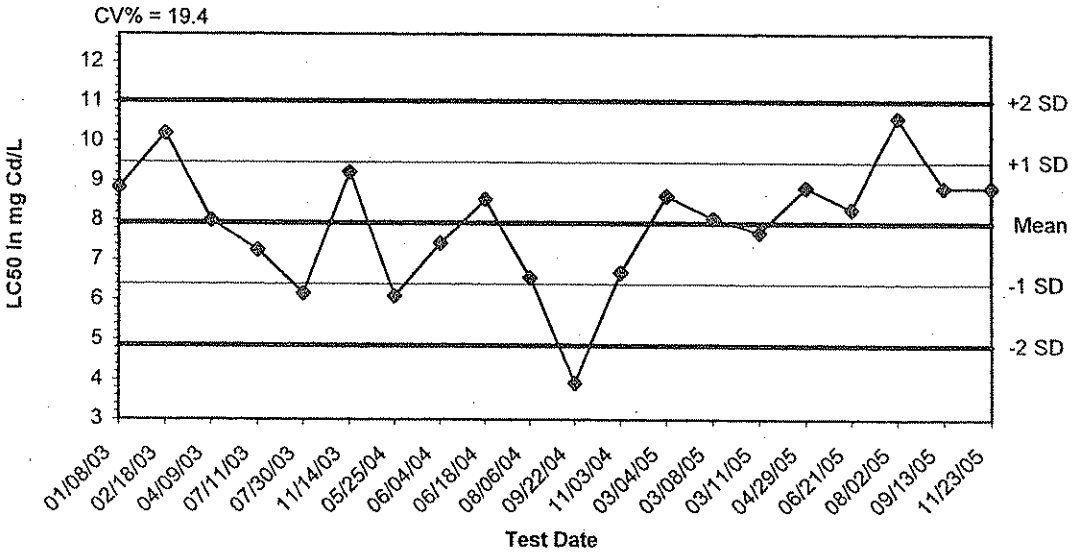
Reference Toxicant 96-h Acute Survival Test — **Northwestern Aquatic Sciences**

Start Date: 28 Feb-06 11:30 AM **Species:** Neanthes arenaceodentata **Sample Code:** 816139556
Ending Date: 04 Mar-06 10:30 AM **Protocol:** **Sample Source:** Reference Toxicant
Sample Date: 28 Feb-06 11:30 AM **Material:** Cadmium chloride **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
MLR
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 ≤0.40 µm, 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 ± 2.1°C; pH, 8.0 ± 0.2; salinity, 31.3 ± 2.0 ‰; dissolved oxygen, 11.2 ± 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 ≥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 ≤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:

PABN (Percent Abnormality) = 100*(A/T)
PABND (Combined Percent Mortality/Abnormality) = 100*((I-N)/I)
PMORT (Percent Mortality) = 100*((I-T)/I)
NPM (Normalized Percent Mortality) = 100*(1-(T/TS))
NCMA (Normalized Combined Percent Mortality/Abnormality) = 100*(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 $CuSO_4 \cdot 5H_2O$ 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 $CuSO_4 \cdot 5H_2O$, 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 µg Cu/L. This result is within the laboratory's control chart ± 2 SD warning limits (7.03 to 14.1 µg 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 ≥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 ≤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

Michele S Redmond 6-13-06
Project Manager Date

Michele S Redmond for
Gerald J. Orisanni 6-13-06
Study Director Date

Richard S. Caldwell 6/13/06
Laboratory 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 ± SD	Minimum	Maximum	N
Temperature (°C)	15.7 ± 0.4	15.0	16.1	24
pH	7.7 ± 0.1	7.5	7.9	24
Salinity (‰)	27.5 ± 0.5	27.0	28.5	24
Dissolved Oxygen (mg/L)	7.6 ± 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 ± 16	0.0 ± 7.1	
REF-EBB (NAS #0426G) [1]	88 ± 34	61.8 ± 15.0	
REF-YB (NAS #0427G) [1]	110 ± 58	52.0 ± 25.3	
SD-100 (NAS #0421G)	45 ± 38	80.2 ± 16.7	*
SD-101 (NAS #0422G)	29 ± 24	87.3 ± 10.6	*
SD-102 (NAS #0423G)	100 ± 64	56.4 ± 28.0	
SD-103 (NAS #0424G)	48 ± 21	79.1 ± 9.1	*
SD-104 (NAS #0425G)	53 ± 20	77.1 ± 8.5	*

[1] 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 ± 7.1	---	---	---	---
REF-EBB (NAS #0426G)[1]	61.8 ± 15.0	---	---	---	---
REF-YB (NAS #0427G)[1]	52.0 ± 25.3	---	---	---	---
SD-100 (NAS #0421G)	80.2 ± 16.7	YES	18.4	YES	NO
SD-101 (NAS #0422G)	87.3 ± 10.6	YES	25.5	YES	NO
SD-102 (NAS #0423G)	56.4 ± 28.0	NO	-5.4	NO	NO
SD-103 (NAS #0424G)	79.1 ± 9.1	YES	17.3	YES	NO
SD-104 (NAS #0425G)	77.1 ± 8.5	YES	15.3	YES	NO

[1] 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 ± 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 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 fiberglas 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 ± 1 °C for oysters (16 ± 1°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 ± 1°C for oysters and 16 ± 1°C for mussels. The salinity is 28 ± 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 ≥ 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	Daily in water quality beakers
Ammonia-N and sulfide	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:

PABN (Percent Abnormality) = 100*(A/T)
PABND (Combined Percent Mortality/Abnormality) = 100*((I-N)/I)
PMORT (Percent Mortality) = 100*((I-T)/I)
NPM (Normalized Percent Mortality) = 100*(1-(T/TS))
NCMA (Normalized Combined Percent Mortality/Abnormality) = 100*(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

_____ for _____
Name Date

_____ for Northwestern Aquatic Sciences
Name Date

APPENDIX II

RAW DATA

TEST DESCRIPTION, MONITORING, AND RESULTS BENCHSHEETS

NORTHWESTERN AQUATIC SCIENCES

PROTOCOL NO. NAS-XXX-CG/MG4
NAS-XXX-SP/DE4

SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

received

Test No. 738-3 Client Kennedy/Jenks Investigator pgp 1-27 MSR 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 MSR / G.J. Irissarri GJI
QA Officer L.K. Nemeth
1. Susan Gage SG 2. Bill Montgomery WM
3. R.S. Caldwell RSC 4. Greg Hutchinson GH
5. G.A. Buhler GAB 6.

Study Schedule:
Test Beginning: 2-21-06 1420 Test 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):	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):					

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

PROTOCOL NO. NAS-XXX-CG/MG4
NAS-XXX-SP/DE4

SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3 Client Kennedy/Jenks Investigator _____

SEDIMENT DESCRIPTIONS -- SUPPLEMENTAL NOTES

Sample No.	Description
0421G	black mud w/ woody & grassy debris; petroleum smell
0422G	black mud w/ chunks of wood
0423G	dark brown mud w/ fibrous material & sticks; petroleum smell
0424G	black mud w/ woody debris
0425G	black sticky mud
0426G	black sticky mud
0427G	black sticky mud w/ some sand

NORTHWESTERN AQUATIC SCIENCES

PROTOCOL NO. NAS-XXX-CG/MG4
NAS-XXX-SP/DE4

SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3 Client Kennedy/Jenks Investigator _____

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~~	~~pH~~ ~~Sal (ppt)~~	~~Sal (ppt)~~ ~~DO (mg/L)~~	Comments
~~2-6-06~~	~~9.0~~	~~9.6~~	~~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~~	~~31.0~~	
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	~~2.4~~ 2.0	
(N)	~~6~~ 3	3 ~~6~~	~~6~~ 3	~~6~~ 3	

MSR 3-31-06 mussels in wrong column

MSR 3-13-06 set 3 exp WQ stn not applicable

Photoperiod during acclimation: Outdoor ambient conditions

TEST WATER

Source: Yaquina Bay, Oregon, sea water

Date of Collection: 2-20-06 Salinity (ppt) 28.0 pH 7.9

Treatments: 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/(PM)

Number 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: 54

Dilution 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; <2-hr old

Subsample size for counting: 10 ml

MISCELLANEOUS NOTES

Light intensity measurements:	Date	Location in room	foot-candles
	2-21-06	beaker #16	100
		#32	87

NORTHWESTERN AQUATIC SCIENCES

PROTOCOL NO. NAS-XXX-CG/MG4
NAS-XXX-SP/DE4

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 #4

Randomization chart: TOP SHELF

3									48
2									47
1									46

Randomization chart:

Randomization chart:

Randomization chart:

Randomization chart:

NORTHWESTERN AQUATIC SCIENCES

PROTOCOL NO. NAS-XXX-CG/MG4
NAS-XXX-SP/DE4

SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3 Client Kennedy/Jenks Investigator _____

WATER QUALITY RECORD

overlying NH3 sampled (day 0 and 2)? yes RSC
overlying S sampled (day 0 and 2)? yes RSC

Day 0 (2/21/06) AS/AF/64

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) WS

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	7.4	
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	

overlying NH3 sampled (day 0 and 2)? yes
overlying S sampled (day 0 and 2)? yes

Day 2 (2/23/06) AS

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	

NORTHWESTERN AQUATIC SCIENCES

PROTOCOL NO. NAS-XXX-CG/MG4
NAS-XXX-SP/DE4

SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3 Client Kennedy/Jenks Investigator

LARVAL COUNT DATA

Beaker no.	Response N	Response A
1	183	~~25~~
2	30	89
3	51	69
4	13	130
5	62	81
6	—	—
7	70	117
8	29	70
9	43	122
10	98	82
11	50	64
12	13	119
13	74	90
14	103	34
15	15	63
16	121	40
17	183	11
18	13	107
19	—	—
20	—	—
21	—	—
22	64	84
23	42	94
24	54	57
25	—	—
26	35	86
27	195	15
28	14	88
29	38	91
30	232	8
31	217	11
32	137	19
33	40	103
34	102	98
35	253	14
36	130	35
37	—	—
38	78	57
39	74	54
40	39	105

Beaker no.	Response N	Response A
41	—	—
42	—	—
43	23	87
44	93	67
45	233	9
46	34	88
47	79	74
48	211	11

Zero time Controls

Beaker no.	Response N	Response A
A	227	
B	241	
C	254	
D	206	
E	233	

NORTHWESTERN AQUATIC SCIENCES

PROTOCOL NO. NAS-XXX-CG/MG4
NAS-XXX-SP/DE4

SEDIMENT LARVAL TEST BASED ON PSEP PROTOCOLS

Test No. 738-3 Client Kennedy/Jenks Investigator _____

3-27-06
GJ

LARVAL COUNT DATA - QC COUNTS

Beaker no.	Response N	Response A
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28	14	81
29	31	88
30	228	GJL 89 3-27-06
31	214	11
32	130	21
33		
34		
35		
36		
37		
38		
39		
40		

Beaker no.	Response N	Response A
41		
42		
43		
44		
45		
46		
47		
48		

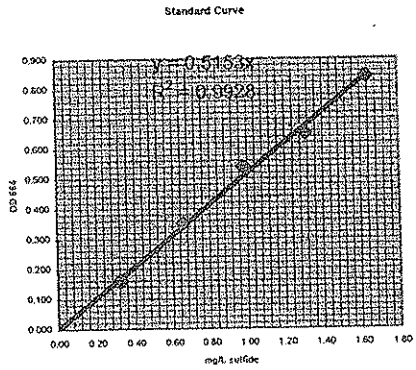
Beaker no.	Response N	Response A

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
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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

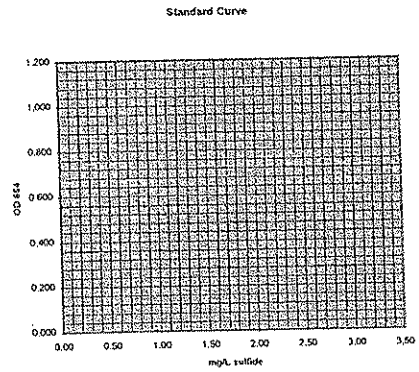
Date analysed: 2/21/2006

Dissolved Sulfide in Water: Computation Worksheet
Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	97	96	99
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.	-----	.350	1.28
3.0 mL working sulfide std.	-----	.540	1.92
4.0 mL working sulfide std.	-----	.650	2.56
5.0 mL working sulfide std.	-----	.840	3.20
3.0 mL spike	-----	.570	
3.0 mL spike dupl.	-----	.522	
1. 6	5	.002	
2. 19	5	.004	
3. 20	5	.000	
4. 21	5	.001	
5. 25	5	.000	
6. 37	5	.004	
7. 41	5	.002	
8. 42	5	.000	



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

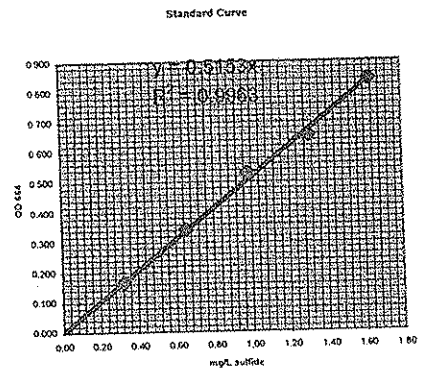
Analyst: RSC

Date analysed: 2/21/2006

Dissolved Sulfide in Water: Computation Worksheet

Methylene Blue Method (SOP #5550)

Standardization	1	2	3
uL PAO titrant employed:	98	100	96
Working Std. Conc. (mg/L):		1.632	



Result

	Sample description	Dilution factor	OD_{664}	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
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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

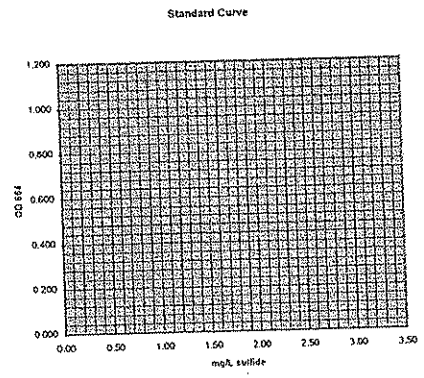
Methylene Blue Method (SOP #5550)

Standardization

	1	2	3
uL PAO titrant employed:	64	100	42
Working Std. Conc. (mg/L):		3.2	

Result

Sample description	Dilution factor	OD664	Sulfide (mg/L)
Blank	----	----	----
1.0 mL working sulfide std.	----	.167	0.64
2.0 mL working sulfide std.	----	.334	1.28
3.0 mL working sulfide std.	----	.530	1.92
4.0 mL working sulfide std.	----	.675	2.56
5.0 mL working sulfide std.	----	.878	3.20
3.0 mL spike	----	.515	
3.0 mL spike dupl.	----	.515	
1. 6	5	.001	
2. 19	5	.007	
3. 20	5	.000	
4. 21	5	.001	
5. 25	5	.001	
6. 37	5	.000	
7. 41	5	.002	
8. 42	5	.004	
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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

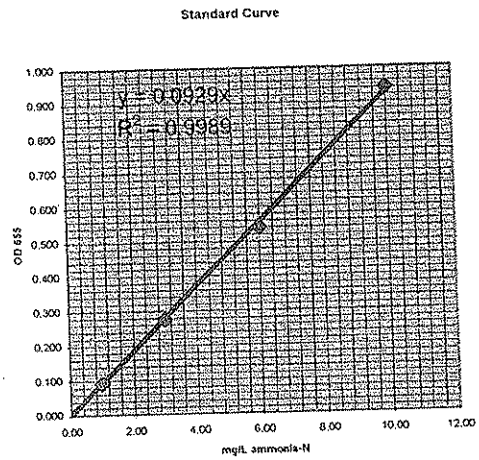
Date analysed: 2/23/2006

Total Ammonia-N in Water: Computation Worksheet

Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	-----	-----	-----
	1.0 mg/L NH_3-N Std.	-----	0.092	1.00
	3.0 mg/L NH_3-N Std.	-----	0.275	3.00
	6.0 mg/L NH_3-N Std.	-----	0.540	6.00
	10.0 mg/L NH_3-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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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*

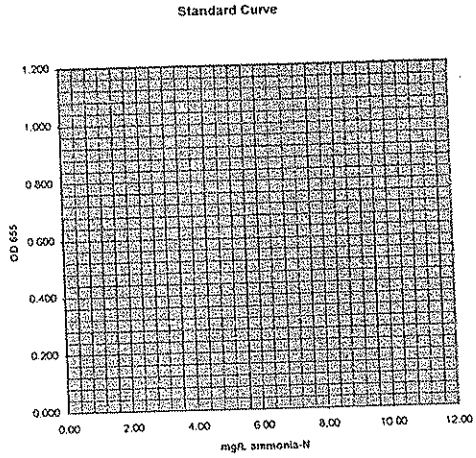
Overlying water

Analyst: RSC
Date analysed: 2/21/2006

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD655	NH_3-N (mg/L)
	Blank	-----	----	----
	1.0 mg/L NH_3-N Std.	-----	.092	1.00
	3.0 mg/L NH_3-N Std.	-----	.275	3.00
	6.0 mg/L NH_3-N Std.	-----	.540	6.00
	10.0 mg/L NH_3-N Std.	-----	.940	10.00
	3.0 mg/L spike	-----	.282	
	3.0 mg/L spike dupl.	-----	.276	
	5.0 mg/L 2nd source	-----	.439	
1.	6	1	.080	
2.	19	1	.089	
3.	20	1	.031	
4.	21	1	.077	
5.	25	1	.072	
6.	37	1	.080	
7.	41	1	.048	
8.	42	1	.021	
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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.: 738-3
Test Day: 0 (2-21-06)
Species: *Mytilus*

Overlying water

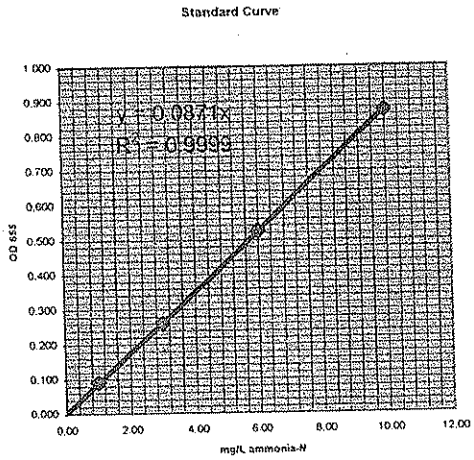
Analyst: RSC
Date analysed: 2/21/2006

Total Ammonia-N in Water: Computation Worksheet

Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	-----	-----	-----
	1.0 mg/L NH_3-N Std.	-----	0.091	1.00
	3.0 mg/L NH_3-N Std.	-----	0.260	3.00
	6.0 mg/L NH_3-N Std.	-----	0.525	6.00
	10.0 mg/L NH_3-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
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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

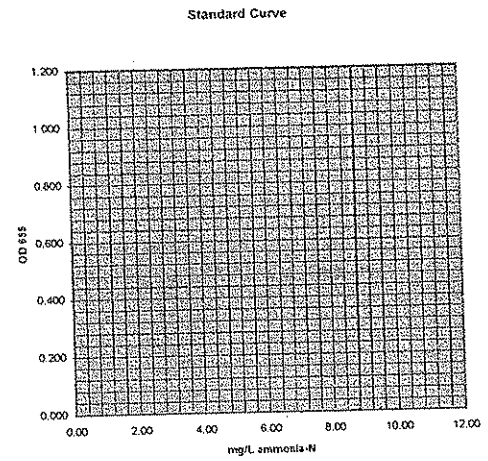
Analyst: RSC

Date analysed: 2/23/2006

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD_{655}	NH_3-N (mg/L)
	Blank	-----	-----	-----
	1.0 mg/L NH_3-N Std.	-----	.091	1.00
	3.0 mg/L NH_3-N Std.	-----	.260	3.00
	6.0 mg/L NH_3-N Std.	-----	.525	6.00
	10.0 mg/L NH_3-N Std.	-----	.870	10.00
	3.0 mg/L spike	-----	.270	
	3.0 mg/L spike dupl.	-----	.278	
	5.0 mg/L 2nd source	-----	.433	
1.	6	1	.050	
2.	19	1	.062	
3.	20	1	.017	
4.	21	1	.048	
5.	25	1	.049	
6.	37	1	.056	
7.	41	1	.022	
8.	42	1	.010	
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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.: 738-3
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

BKR	NAS SMPL	CLIENT 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

Larval Sediment Test

Test no. 738-3

Endpoints Data Entry and Calculations File

BKR=beaker number
INIT=number of inoculated embryos (from average of zero-time counts)
NORM=number normal
ABN=number abnormal
TOTAL=NORM+ABN
PMORT=percent mortality=100((INIT-TOTAL)/INIT)
PABN=percent abnormality=100(ABN/TOTAL)
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

zero counts	
a	221
b	241
c	254
d	206
e	233
Mean =	231

NS (mean normal)	TS (mean total)
229.2	239.8

%normal in SW cont relative to INIT
99.2

Data entry verified against laboratory bench sheets MSR 3-27-06

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL		INIT	NORM	ABN	TOTAL	PMORT	PABN	PABND	NPM	NCMA
1	35	swcontrol	swcontrol	1		231	253	14	267	-15.6	5.2	-9.5	-11.3	-10.4
2	31	swcontrol	swcontrol	2		231	217	11	228	1.3	4.8	6.1	4.9	5.3
3	30	swcontrol	swcontrol	3		231	232	8	240	-3.9	3.3	-0.4	-0.1	-1.2
4	45	swcontrol	swcontrol	4		231	233	9	242	-4.8	3.7	-0.9	-0.9	-1.7
5	48	swcontrol	swcontrol	5		231	211	11	222	3.9	5.0	8.7	7.4	7.9
6	42	swcontrol	swcontrol	6	wq replicate	231								
7	18	0421G	SD-100	1		231	13	107	120	48.1	89.2	94.4	50.0	94.3
8	2	0421G	SD-100	2		231	30	89	119	48.5	74.8	87.0	50.4	86.9
9	10	0421G	SD-100	3		231	98	82	180	22.1	45.6	57.6	24.9	57.2
10	38	0421G	SD-100	4		231	73	57	130	43.7	43.8	68.4	45.8	68.2
11	12	0421G	SD-100	5		231	13	119	132	42.9	90.2	94.4	45.0	94.3
12	41	0421G	SD-100	6	wq replicate	231								
13	28	0422G	SD-101	1		231	14	88	102	55.8	86.3	93.9	57.5	93.9
14	7	0422G	SD-101	2		231	70	117	187	19.0	62.6	69.7	22.0	69.5
15	15	0422G	SD-101	3		231	15	63	78	66.2	80.8	93.5	67.5	93.5
16	4	0422G	SD-101	4		231	13	130	143	38.1	90.9	94.4	40.4	94.3
17	46	0422G	SD-101	5		231	34	88	122	47.2	72.1	85.3	49.1	85.2

	NORM	PMORT	PABN	PABND	NPM	NCMA
Mean	229.2	-3.8	4.4	0.8	0.0	0.0
S.D.	16.3	7.5	0.8	7.1	7.2	7.1
n	5	5	5	5	5	5
Mean	45.4	41.0	68.7	80.3	43.2	80.2
S.D.	38.3	10.9	22.7	16.6	10.5	16.7
n	5	5	5	5	5	5
Mean	29.2	45.3	78.5	87.4	47.3	87.3
S.D.	24.4	18.0	11.3	10.6	17.3	10.6
n	5	5	5	5	5	5

Page 18 of 27

Test no. 738-3

Larval Sediment Test

3/27/06

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL		INIT	NORM	ABN	TOTAL	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
20	16	0423G	SD-102	2		231	121	40	161	30.3	24.8	47.6	32.9	47.2
21	23	0423G	SD-102	3		231	42	94	136	41.1	69.1	81.8	43.3	81.7
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
26	26	0424G	SD-103	2		231	35	86	121	47.6	71.1	84.8	49.5	84.7
27	9	0424G	SD-103	3		231	43	122	165	28.6	73.9	81.4	31.2	81.2
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
32	40	0425G	SD-104	2		231	39	105	144	37.7	72.9	83.1	39.9	83.0
33	5	0425G	SD-104	3		231	62	81	143	38.1	56.6	73.2	40.4	72.9
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
38	29	0426G	REF-EBB	2		231	38	91	129	44.2	70.5	83.5	46.2	83.4
39	14	0426G	REF-EBB	3		231	103	34	137	40.7	24.8	55.4	42.9	55.1
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
44	11	0427G	REF-YB	2		231	50	64	114	50.6	56.1	78.4	52.5	78.2
45	32	0427G	REF-YB	3		231	133	19	152	34.2	12.5	42.4	36.6	42.0
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								

	NORM	PMORT	PABN	PABND	NPM	NCMA
Mean	100.0	26.4	44.4	56.7	29.1	56.4
S.D.	64.1	14.5	28.1	27.7	13.9	28.0
n	5	5	5	5	5	5
Mean	47.8	38.7	67.1	79.3	41.0	79.1
S.D.	20.9	10.9	10.8	9.1	10.5	9.1
n	5	5	5	5	5	5
Mean	52.6	43.7	60.0	77.2	45.8	77.1
S.D.	19.6	10.2	11.2	8.5	9.8	8.5
n	5	5	5	5	5	5
Mean	87.6	37.7	40.1	62.1	40.0	61.8
S.D.	34.3	7.6	19.5	14.9	7.3	15.0
n	5	5	5	5	5	5
Mean	110.0	36.3	29.4	52.4	38.6	52.0
S.D.	58.0	14.2	25.0	25.1	13.6	25.3
n	5	5	5	5	5	5

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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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.1
Calculated Value:	1.8948
Critical Value:	>= 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	Shipiro-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

MSR 6-5-06

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.

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis
Null: x1 <= x2
Alternate: x1 > x2

Degrees of Freedom:	8
Experimental Alpha Level:	0.1
Calculated Value:	3.2113
Critical Value:	>= 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	Shipiro-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. MLR 6-5-06

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.

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin
Experimental Hypothesis	
Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.1
Calculated Value:	-0.3743
Critical Value:	>= 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	Shipiro-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. msR 6-5-06

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.

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.1
Calculated Value:	2.1868
Critical Value:	>= 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	Shipiro-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

MSR 6-5-06

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.

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:

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:	<= 0.842
Normally Distributed:	Yes
Override Option:	N/A

Levene's Results:

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:	>= 1.86
Variances Homogeneous:	Yes

Test Results:

Statistic:	Student's t
Balanced Design:	Yes
Transformation:	ArcSin

Experimental Hypothesis

Null:	x1 <= x2
Alternate:	x1 > x2
Degrees of Freedom:	8
Experimental Alpha Level:	0.1
Calculated Value:	1.9365
Critical Value:	>= 1.397
Accept Null Hypothesis:	No
Power:	
Min. Difference for Power:	

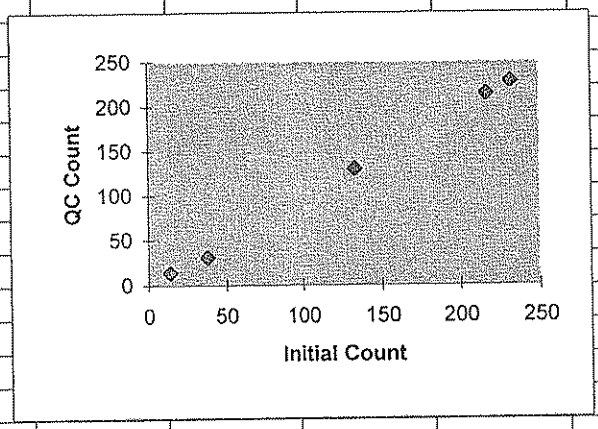
Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	87.3	69.122	43.3	41.15	7.449	11.014			-11.014
2	83	65.65	83.4	65.956	3.977	13.793			-7.644
3	72.9	58.629	55.1	47.927	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. MLR 6-5-06

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.

Comparison of Initial Counts and QC Counts

	Normal Larvae				
Beaker	Initial Count		QC Count		
No.	Normal	Abnormal	Normal	Abnormal	cv(normal)
28	14	88	14	81	0
29	38	91	31	88	14
30	232	8	228	9	1
31	217	11	214	11	1
32	133	19	130	21	2



Intercept	-3.118723
Slope	0.997782
r square	0.99937

Data entry verified against laboratory bench sheets MSR 3-27-06

Water Quality Data File

BKR	NAS SMPL	CLIENT 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	16
				Min	15.0	7.5	27.0	6.4	<0.1	0.1
				Max	16.1	7.9	28.5	8.1	<0.1	1.0

Data entry verified against laboratory bench sheets

MER
3-27-06

CHAIN-OF-CUSTODY RECORDS

Sample Chain-of-Custody/Analysis Request

Kennedy/Jenks Consultants

Possible Hazards

Client: Enviro Logic Resources
Site: Astoria Area-Wide
Project No.: 0592004.00
Sampler Name: Tom Pinit / Cindy Ryals
Telephone: 503-295-4911

Report to: Taku Fuji
Company: Kennedy / Jenks
Address: 200 SW Market St. #500 Portland, OR 97201
Fax: 503-295-4901

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.	(1) Client ID No.	Collection Date	Collection Time	(2) Type	Depth	(3) Comp.	(4) Pres.	Turn around	(5) Analyses Requested	Comment/Conditions (container type, container number, etc.)
	SD-100	1/26/06	1145	S		0421G	DASF		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
										jars were filled (-no head space)
										cooler 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 Relinquished By					Sample Received By				
Print Name	Signature	Company	Date	Time	Print Name	Signature	Company	Date	Time
P. THOMAS PINIT	P. Jedlicka	K/J	1/27/06	1240	Michele S. Redmond	Michele S. Redmond	NAS	1-27-06	13:45

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REFERENCE TOXICANT RESULTS AND ANALYSIS

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-CG/MG2
BIVALVE LARVAL TEST BASED ON EPA/600/R-95/136

REVIEWED PAGES 1-9 GJI MSR 6-13-06

Test No. 999-2078 Client: QC Test Investigator

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. Irissarri GJI
QA Officer L.K. Nemeth
1. Susan Gape SG 2. M.S. Redmond MSR
3. GA Sibbalds GAS 4.
Study Schedule:
Test Beginning: 2-21-06 1535 hrs Test Ending: 2-23-06 1500 hrs

TEST MATERIAL

Description: Copper as $CuSO_4 \cdot 5H_2O$, 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: (3) ~~2-7-06~~ 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	9.8	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~~	
2-15-06	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	~~10.1~~ 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	

MSR 6-13-06 first 3 days WQ data not applicable

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/PM

Number of organisms used: females: 9 males: 4

Egg Dilution (1 ml diluted to 100 ml):

Count/ml of dilution: 1. 46 2. 56 3. 41 Mean: 54

Dilution factor = DF (mean x 100/2500) = 1:1

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): 4

Organisms/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	0	32	2	16	8	64	4	1		
B	4	8	2	64	0	1	32	16		
C	64	16	4	2	32	8	1	0		
D	32	64	0	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

$$VB = VE \frac{(TS - SE)}{(SB - TS)} = VE \frac{(\quad - \quad)}{(\quad - \quad)} = VE (\quad)$$

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 GJ

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 → 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 → 100mL) dilution of 1st working stock. Final concentration 2 ug/mL.

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-CG/MG2

BIVALVE LARVAL TEST BASED ON EPA/600/R-95/136

Test No. 999-2078 Client QC Test Investigator

WATER QUALITY DATA

Date: 2-21-06 initials: sf/MB Date: 2-23-06 initials: sf

Conc. (ug/L)	Temp. (deg.C)	DO (mg/L)	Sal. (ppt)	pH	Temp. (deg.C)	DO (mg/L)	Sal. (ppt)	pH
	@8:55 2/21/06 15.2							
64	15.2	8.0	29.5	7.9	15.6	7.9	29.5	8.0
32	15.3	8.0	29.5	7.9	15.6	7.9	29.5	8.0
16	15.3	8.0	30.0	7.9	15.6	7.9	30.0	8.0
8	15.3	8.0	30.0	7.9	15.6	7.9	30.0	8.0
4	15.2	8.1	30.0	7.9	15.6	7.9	30.0	8.0
2	15.3	8.0	30.0	7.9	15.6	7.9	30.0	8.0
1	15.3	8.0	30.0	7.9	15.5	7.9	30.5	8.0
Control	15.3	8.0	30.0	7.9	15.6	7.8	30.0	8.0
Brine control	---	---	---	---	---	---	---	---

WATER QUALITY:

	Mean	SD	N
Temperature (°C):	15.4	0.2	16
DO (mg/L):	8.0	0.1	16
Salinity (ppt):	29.9	0.3	16
pH:	8.0	0.1	16

WATER BATH TEMPERATURE (°C):

Day 0: 15.3 Day 0: 15.5

Day 1: 16.0 Day 1: 15.9

Day 2: 15.6 Day 2: 15.7

LARVAL COUNT DATA

3-14-06 sf

Conc. (ug/L)	Replicate 1		Replicate 2		Replicate 3		Replicate 4	
	N	A	N	A	N	A	N	A
64	0	1	0	0	0	0	0	1
32	0	41	0	31	0	45	0	27
16	0	182	0	175	0	183	0	174
8	122	70	139	72	114	87	127	78
4	184	12	169	9	182	12	168	10
2	183	10	168	13	182	8	188	12
1	178	7	183	9	186	13	177	9
Control	177	12	191	10	176	13	178	10
Brine control	---	---	---	---	---	---	---	---
Zero time	185	198	189	188	188	209		

Zero time: Mean 193 SD 9 N 6 CV=(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

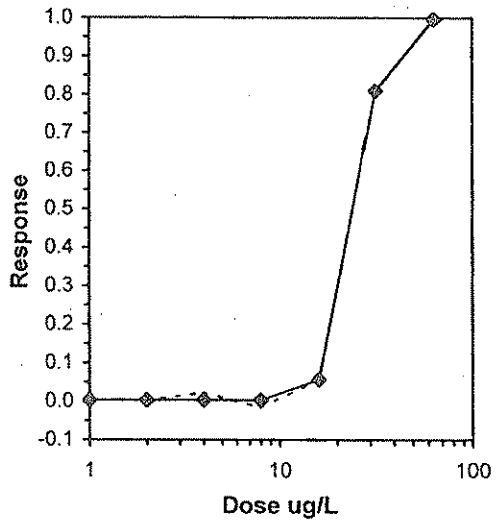
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
D-Control	0.9832	1.0000	1.4491	1.4091	1.5348	3.980	4				13	772
1	0.9793	0.9960	1.4446	1.3658	1.5348	5.869	4	0.082	2.480	0.1361	16	772
2	0.9806	0.9974	1.4585	1.3188	1.5348	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-Karber

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

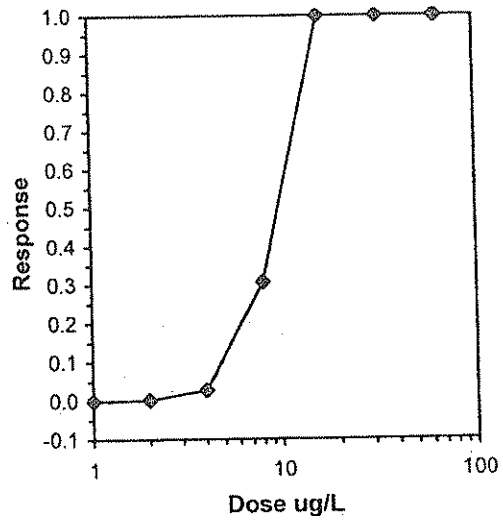
			Transform: Arcsin Square Root					1-Tailed			Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
D-Control	0.9352	1.0000	1.3263	1.2695	1.4688	7.186	4				50	772
1	0.9378	1.0028	1.3218	1.2787	1.3792	3.561	4	0.085	2.360	0.1253	48	772
2	0.9339	0.9986	1.3207	1.2026	1.4091	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-Karber

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

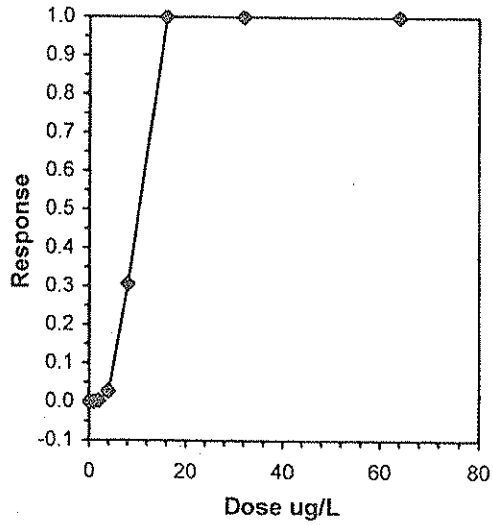
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.9352	1.0000	1.3263	1.2695	1.4688	7.186	4				0.9365	1.0000
1	0.9378	1.0028	1.3218	1.2787	1.3792	3.561	4	0.085	2.360	0.1253	0.9365	1.0000
2	0.9339	0.9986	1.3207	1.2026	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	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

Linear Interpolation (200 Resamples)

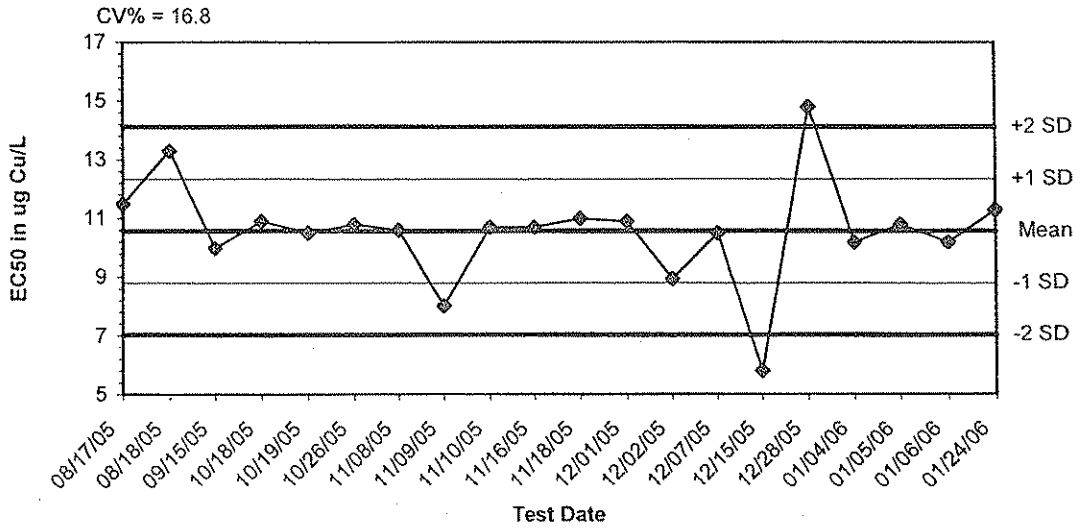
Point	ug/L	SD	95% CL(Exp)		Skew
IC05	4.321	0.673	0.575	4.904	-1.9841
IC10	5.041	0.294	3.758	5.664	-0.7162
IC15	5.760	0.272	4.647	6.468	-0.3794
IC20	6.480	0.286	5.577	7.405	0.0091
IC25	7.199	0.329	6.322	8.305	0.2521
IC40	9.087	0.264	8.213	9.817	-0.1884
IC50	10.239	0.220	9.511	10.847	-0.1884



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

MR
3-15-06

Appendix E

Chemical Data Quality Review

Appendix E: Chemical Data Quality Review

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.

APPENDIX J

Appendix J presents the search results for well logs in Sections 7 and 18 Township 8 North, Range 9 West and Section 12 and 13, Township 8 North, Range 10 West using Oregon Water Resources Department on-line Ground-water Resource Information Distribution (GRID) database, search date March 16, 2007.

TABLE J -1

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 13 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Name Last	Log Type	First Water	Depth Drilled	Static Water	Date Completed	Work New	work_abandonment	Well Address
CLAT	382			M		12	9	8/20/1993	X	X	1 PORTWAY
CLAT	383			M	9	11	9	8/19/1993	X	X	1 PORTWAY
CLAT	51168		BIRDWELL	G		50	15	7/18/2001	X	X	710 W MARINE DR
CLAT	51170		BIRDWELL	G		47		7/17/2001	X	X	710 W MARINE DR
CLAT	51195			G		14		9/11/2001	X	X	710 W MARINE DR
CLAT	51196			G		15		9/11/2001	X	X	710 W MARINE DR
CLAT	51197			G		15		9/11/2001	X	X	710 W MARINE DR
CLAT	51198			G		8		9/11/2001	X	X	710 W MARINE DR
CLAT	51199			G		12		9/11/2001	X	X	710 W MARINE DR
CLAT	51200			G		8		9/11/2001	X	X	710 W MARINE DR
CLAT	51201			G		8		9/11/2001	X	X	710 W MARINE DR
CLAT	51202			G		8		9/10/2001	X	X	710 W MARINE DR
CLAT	51203			G		8		9/10/2001	X	X	710 W MARINE DR
CLAT	51204			G		11		9/10/2001	X	X	710 W MARINE DR
CLAT	51205			G		8		9/10/2001	X	X	710 W MARINE DR
CLAT	51206			G		16		9/10/2001	X	X	710 W MARINE DR
CLAT	51207			G		13		9/10/2001	X	X	710 W MARINE DR
CLAT	51208			G		11		9/10/2001	X	X	710 W MARINE DR
CLAT	51840	67557		M	4	15	4	10/21/2003	X		FLORENCE AVE AND TAYLOR AVE
CLAT	52068	76197		M	12	20	12	6/24/2004	X		W MARINE DR;FLORENCE AVE & DRESDEN ST
CLAT	52069			G		20	12	6/24/2004	X	X	W MARINE DR; FLORENCE & DRESDEN ST
CLAT	52281			W	10	30	9	5/26/2005	X		
CLAT	52282			W	10	30	9	5/26/2005	X		
CLAT	52283			W	10	30	9	5/25/2005	X		
CLAT	52284			W	10	30	9	5/25/2005	X		
CLAT	52285			W	10	30	9	5/24/2005	X		
CLAT	52323	76197		M		20	8.9	5/26/2005		X	W MARINE DR; W SHOULDER; 100' N DRESDEN
CLAT	52416			W				10/12/2005		X	
CLAT	52417			W				10/12/2005		X	RIGHT OF WAY
CLAT	52418			W				10/12/2005		X	RIGHT OF WAY
CLAT	52419			W				10/12/2005		X	RIGHT OF WAY
CLAT	52420			W				10/12/2005		X	RIGHT OF WAY

TABLE J –2

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	51			M	14	20	14	5/14/1991	X		
CLAT	52			M	25	30	14	5/14/1991	X		
CLAT	53			M	14	19	14	5/14/1991	X		
CLAT	54			M	16	25	14	5/15/1991	X		
CLAT	55			M	11	20	11	5/15/1991	X		
CLAT	62			M	10	14	10	9/5/1991	X		85 W MARINE DR
CLAT	63			M	9	16	9	7/16/1991	X		510 MARINE DR, ASTORIA
CLAT	82			M	20	40	16	12/3/1991	X		460 W MARINE DR, ASTORIA 97103
CLAT	287			W		400		5/9/1986	X		W MARINE DR, ASTORIA
CLAT	315			M	10	15	10	3/5/1992	X		85 W MARINE DR
CLAT	316			M	10	15	10	3/5/1992	X		85 W MARINE DR
CLAT	324		MOONEY	M	7	10	7	5/28/1992	X		75 W MARINE DR, ASTORIA
CLAT	325		MOONEY	M	7	15	7	5/28/1992	X		75 W MARINE DR, ASTORIA
CLAT	326		MOONEY	M	7	10	7	5/28/1992	X		75 W MARINE DR, ASTORIA
CLAT	339			M	2	19	2	12/10/1992	X		
CLAT	341			M	37	39		12/14/1992	X	X	
CLAT	389			M	0	0	0			X	10 5TH ST, ASTORIA
CLAT	390			M	10	20	10	10/28/1993	X		10 5TH ST, ASTORIA
CLAT	391			M	10	20	10	10/28/1993	X		10 5TH ST, ASTORIA
CLAT	392			M	0	0	0			X	10 5TH ST, ASTORIA
CLAT	436			M		20		6/24/1994	X		256 MARINE DR, ASTORIA
CLAT	437			M	4	11	3.3	6/24/1994	X		256 MARINE DR, ASTORIA
CLAT	438			M	4	11	3.6	6/24/1994	X		256 MARINE DR, ASTORIA
CLAT	447			M	8	15	10.2	9/21/1994	X		95 W MARINE DR
CLAT	488			M	8	20	8	2/2/1995	X		TERMINAL 0022
CLAT	489			M	11	23	11	2/2/1995	X		TERMINAL 0022
CLAT	490			M	8	20	8	2/3/1995	X		TERMINAL 0022
CLAT	512			M	0	0	0			X	
CLAT	50135		MOONEY JR	M	3	7	4	4/26/1996	X		75 W MARINE DR, ASTORIA
CLAT	50136		MOONEY JR	M	3	7	4	4/26/1996	X		75 W MARINE DR, ASTORIA

TABLE J –2

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	50137		MOONEY JR	M	4	9	4	4/26/1996	X		75 W MARINE DR, ASTORIA
CLAT	50241		ED NIEMI	G		8	5.5	1/16/1997	X		455 INDUSTRIAL
CLAT	50242		ED NIEMI	G		8	5.5	1/16/1997	X		455 INDUSTRIAL
CLAT	50243		ED NIEMI	G		12	5.5	1/16/1997	X		455 INDUSTRIAL
CLAT	50244		ED NIEMI	G		12	5.5	1/16/1997	X		455 INDUSTRIAL
CLAT	50245		ED NIEMI	G		12	5.5	1/16/1997	X		455 INDUSTRIAL
CLAT	50246		ED NIEMI	G		12	5.5	1/16/1997	X		455 INDUSTRIAL
CLAT	50248		ED NIEMI	G		4	2	1/16/1997	X		455 INDUSTRIAL
CLAT	50249		ED NIEMI	G		4	2	1/16/1997	X		455 INDUSTRIAL
CLAT	50298		PARK	G		30		4/17/1997	X		515 15TH STREET
CLAT	50299		PARK	G		20		4/17/1997	X		515 15TH STREET
CLAT	50300		PARK	G		20		4/17/1997	X		515 15TH STREET
CLAT	50315		CHEVRON	M		19		5/27/1997		X	105TH ST, ASTORIA
CLAT	50316		CHEVRON	M		19		5/27/1997		X	10 5TH ST, ASTORIA
CLAT	50317		CHEVRON	M		20		5/27/1997		X	10 5TH ST, ASTORIA
CLAT	50318		CHEVRON	M		17		5/30/1997		X	10 TH ST, ASTORIA
CLAT	50356	11342		M	5	9	5	8/18/1997	X		490 W MARINE DR
CLAT	50357	11343		M	5	9	5	8/18/1997	X		490 W MARINE DR
CLAT	50467	11342		M	4		4	3/9/1998		X	
CLAT	50468	11343		M	4		4	3/9/1998		X	
CLAT	50555		PATERSON	G		21	8	6/29/1998	X		95 W MARINE DR
CLAT	50556		PATERSON	G		21	8	6/29/1998	X		95 W MARINE DR
CLAT	50557		PATERSON	G		21	8	6/29/1998	X		95 W MARINE DR
CLAT	50558		PATERSON	G		20	8	6/29/1998	X		95 W MARINE DR
CLAT	50559		PATERSON	G		20	8	6/29/1998	X		95 W MARINE DR
CLAT	50560		PATERSON	G		17	8	6/29/1998	X		95 W MARINE DR
CLAT	50561		PATERSON	G		17	8	6/29/1998	X		95 W MARINE DR
CLAT	50562		PATERSON	G		17	8	6/29/1998	X		95 W MARINE DR
CLAT	50966			M		23		11/16/1999		X	256 MARINE DR, ASTORIA
CLAT	50967			M		17		11/16/1999		X	256 MARINE DR, ASTORIA

TABLE J –2

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	50968			M				11/16/1999		X	256 MARINE DR, ASTORIA
CLAT	50929	33378		M	10	48	10	10/21/1998	X		256 MARINE DR, ASTORIA
CLAT	50930	33376		M	11	36	11	10/20/1998	X		256 MARINE DR, ASTORIA
CLAT	50931	33377		M	11	23	11	10/22/1998	X		256 MARINE DR, ASTORIA
CLAT	50973	33558	PATTERSON	M	9	20	9	11/24/1999	X		95 W MARINE DR
CLAT	51144		CHOPPING	G		25		4/13/2001	X	X	168 DUANE ST, ASTORIA
CLAT	51145		CHOPPING	G		25		4/13/2001	X	X	168 DUANE ST, ASTORIA
CLAT	51146		CHOPPING	G		50		4/13/2001	X	X	168 DUANE ST, ASTORIA
CLAT	51178	29787	CAPE	M				8/3/2001		X	95 W MARINE DR
CLAT	51180	33558	CAPE	M				8/3/2001		X	95 MARINE DR
CLAT	51181		CAPE	M				8/3/2001		X	95 MARINE DR
CLAT	51182		CAPE	M				8/3/2001		X	95 MARINE DR
CLAT	51230			G		24	18	9/17/2001	X	X	495 MARINE DR
CLAT	51231			G		16		9/17/2001	X	X	495 MARINE DR
CLAT	51232			G		24	18	9/17/2001	X	X	495 MARINE DR
CLAT	51300	26580		M				1/16/2002			256 MARINE DR, ASTORIA
CLAT	51301	26579		M				1/16/2002			256 MARINE DR, ASTORIA
CLAT	51302	26581		M				1/16/2002			256 MARINE DR, ASTORIA
CLAT	51303	26576		M				1/16/2002			256 MARINE DR, ASTORIA
CLAT	51304	26577		M				1/16/2002			256 MARINE DR, ASTORIA
CLAT	51305	26578		M				1/16/2002			256 MARINE DR, ASTORIA
CLAT	51451			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51452			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51453			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51454			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51455			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51456			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51457			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51458			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51459			G		12		8/29/2002	X	X	ONE PORT WAY

TABLE J –2

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	51460			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51461			G		12		8/29/2002	X	X	ONE PORT WAY
CLAT	51462		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51463		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51464		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51465		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51466		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51467		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51468		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51469		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51471		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51472		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51473		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51474		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51475		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51476		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51477		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51478		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51479		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51480		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51481		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51482		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51484		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51485		LEVOFF	G		12	8	8/27/2002	X	X	481 INDUSTRY ST
CLAT	51486		LEVOFF	G		16	12	8/28/2002	X	X	481 INDUSTRY ST
CLAT	51487		LEVOFF	G		16	12	8/28/2002	X	X	481 INDUSTRY ST
CLAT	51488		LEVOFF	G		16	12	8/28/2002	X	X	481 INDUSTRY ST
CLAT	51489		LEVOFF	G		16	12	8/28/2002	X	X	481 INDUSTRY ST
CLAT	51490		LEVOFF	G		16	12	8/28/2002	X	X	481 INDUSTRY ST
CLAT	51491		LEVOFF	G		16	12	8/28/2002	X	X	481 INDUSTRY ST

TABLE J –2

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	51492		LEVOFF	G		16	12	8/28/2002	X	X	481 INDUSTRY ST
CLAT	51493		LEVOFF	G		9		8/29/2002	X	X	481 INDUSTRY ST
CLAT	51494		LEVOFF	G		9		8/29/2002	X	X	481 INDUSTRY ST
CLAT	51495		LEVOFF	G		9		8/29/2002	X	X	481 INDUSTRY ST
CLAT	51496		LEVOFF	G		9		8/29/2002	X	X	481 INDUSTRY ST
CLAT	51497			G		12	4.1	8/23/2002	X	X	ONE PORT WAY
CLAT	51498			G		12	4.1	8/23/2002	X	X	ONE PORT WAY
CLAT	51499			G		12	4.1	8/20/2002	X	X	ONE PORT WAY
CLAT	51500			G		12	4.1	8/20/2002	X	X	ONE PORT WAY
CLAT	51501			G		12	4.1	8/20/2002	X	X	ONE PORT WAY
CLAT	51502			G		12	4.1	8/20/2002	X	X	ONE PORT WAY
CLAT	51503			G		12	4.1	8/20/2002	X	X	ONE PORT WAY
CLAT	51504			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51505			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51506			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51507			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51508			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51509			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51510			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51511			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51512			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51513			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51514			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51515			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51516			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51517			G		12	4.1	8/21/2002	X	X	ONE PORT WAY
CLAT	51518		TUSSING	G		12	6.5	8/23/2002	X	X	460 W MARINE DR
CLAT	51519		TUSSING	G		12	6.5	8/23/2002	X	X	460 W MARINE DR
CLAT	51520		TUSSING	G		12	6.5	8/23/2002	X	X	460 W MARINE DR
CLAT	51521		TUSSING	G		12	6.5	8/23/2002	X	X	460 W MARINE DR

TABLE J –2

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	51522		TUSSING	G		12	6.5	8/23/2002	X	X	460 W MARINE DR
CLAT	51523		TUSSING	G		12	6.5	8/23/2002	X	X	460 W MARINE DR
CLAT	51524		TUSSING	G		12	6.5	8/23/2002	X	X	460 W MARINE DR
CLAT	51525		TUSSING	G		20		8/22/2002	X	X	460 W MARINE DR
CLAT	51526		TUSSING	G		24	2	8/23/2002	X	X	460 W MARINE DR
CLAT	51527		TUSSING	G		26	4	8/23/2002	X	X	460 W MARINE DR
CLAT	51528			G		12	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51529			G		12	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51530			G		12	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51531			G		12	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51532			G		12	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51533			G		12	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51534			G		12	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51535			G		16	4.6	8/26/2002	X	X	13 PORT WAY
CLAT	51547			G		12	1.6	8/20/2002	X	X	65 PORTWAY ST
CLAT	51548			G		12	1.6	8/20/2002	X	X	65 PORTWAY ST
CLAT	51549			G		12	1.6	8/20/2002	X	X	65 PORTWAY ST
CLAT	51550			G		11	1.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51551			G		11	1.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51552			G		11	1.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51553			G		11	1.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51555			G		11	1.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51556			G		8	1.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51557			G		8	1.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51558			G		16	6.6	8/20/2002	X	X	65 PORTWAY ST
CLAT	51559			G		16	6.6	8/20/2002	X	X	65 PORTWAY ST
CLAT	51560			G		15		8/20/2002	X	X	65 PORTWAY ST
CLAT	51561			G		15		8/20/2002	X	X	65 PORTWAY ST
CLAT	51562			G		24	2.9	8/20/2002	X	X	65 PORTWAY ST
CLAT	51563			G		24	2.9	8/20/2002	X	X	65 PORTWAY ST

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WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	51601	61721	FERRELL	M	6	15	6	4/14/2003	X		210 W MARINE DR, ASTORIA
CLAT	51602	54928	FERRELL	M	6	15	6	4/14/2003	X		210 W MARINE DR, ASTORIA
CLAT	51603	54937	FERRELL	M	6	15	6	4/14/2003	X		210 W MARINE DR, ASTORIA
CLAT	51604	61725	FERRELL	M	6	15	6	4/14/2003	X		210 W MARINE DR, ASTORIA
CLAT	51605	63025	FERRELL	M	6	15	6	4/14/2003	X		210 W MARINE DR, ASTORIA
CLAT	51612		DION	G		25	5	1/27/2003	X	X	CORNER OF MARINE AND COLUMBIA, ASTORIA; OLD TVBS PRO
CLAT	51613		DION	G		25	7	1/27/2003	X	X	CORNER OF MARINE AND COLUMBIA, ASTORIA; OLD TVBS PRO
CLAT	51614		DION	G		35	5	1/28/2003	X	X	CORNER OF MARINE AND COLUMBIA, ASTORIA; OLD TVBS PRO
CLAT	51615		DION	G		31.5	5	1/28/2003	X	X	CORNER OF MARINE AND COLUMBIA, ASTORIA; OLD TVBS PRO
CLAT	51642	63020		M		35	12	5/16/2003	X		256 MARINE DR, ASTORIA
CLAT	51643	63021		M	12	30	12	5/13/2003	X		256 MARINE DR, ASTORIA
CLAT	51649	54928	FERRELL	M	6	15	6	6/27/2003			210 W MARINE DR, ASTORIA
CLAT	51725	58861		M	12	26	12	8/5/2003	X		352 INDUSTRIAL WAY
CLAT	51742	58675	LEVOFF	M	10	15	10	9/5/2003	X		481 INDUSTRY ST
CLAT	51743	58685		M	19	25	19	8/30/2003	X		452 W MARINE DR
CLAT	51744	58686		M	10	15	10	9/7/2003	X		INDUSTRIAL ST
CLAT	51745	58684		M	10	15	10	9/7/2003	X		455 INDUSTRY ST
CLAT	51746	58680		M	10	15	10	9/7/2003	X		65 PORTWAY
CLAT	51747	58679		M	10	15	10	8/20/2003	X		455 INDUSTRY ST
CLAT	51748	58678		M	10	15	10	9/6/2003	X		455 INDUSTRY ST
CLAT	51749	58677	TUSSING	M	10	15	10	9/6/2003	X		460 W MARINE DR
CLAT	51750	58683		M	10	18	10	9/8/2003	X		65 PORTWAY
CLAT	51751	58682		M	19	25	19	9/7/2003	X		452 W MARINE DR
CLAT	51752	58681		M	10	15	10	9/7/2003	X		65 PORTWAY
CLAT	51753	58662		M	10	15	10	9/2/2003	X		INDUSTRIAL ST; LOT NEXT TO SHELL OIL SITE
CLAT	51761	58666		M	10	15	10	9/2/2003	X		INDUSTRIAL ST; SHELL OIL SITE
CLAT	51762	58665		M	10	15	10	9/2/2003	X		INDUSTRIAL ST; LOT NEXT TO SHELL OIL SITE
CLAT	51765	58670		M	10	15	10	9/4/2003	X		PORTWAY; NEAR HAMBURG ST
CLAT	51766	58669		M	10	15	10	9/4/2003	X		PORTWAY; NEAR HAMBURG ST
CLAT	51767	58668		M	10	15	10	9/3/2003	X		INDUSTRY ST; SHELL OIL

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WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	51768	58667		M	10	15	10	9/3/2003	X		INDUSTRY ST; SHELL OIL SITE
CLAT	51769	58676	LEVOFF	M	10	15	10	9/5/2003	X		481 INDUSTRY ST
CLAT	51792			G		61	10	5/7/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51793			G		68	10	5/8/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51794			G		68	10	5/8/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51795			G		35	10	5/9/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51796			G		76	10	5/11/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51797			G		69	10	5/12/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51798			G		34	12	5/12/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51799			G		66	12	5/15/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51800			G		67.5	12	5/15/2003	X	X	256 MARINE DR, ASTORIA
CLAT	51809			G		40		6/17/2003	X	X	180 W IRVING AVE
CLAT	51810	61721	DION	W	6	15	7	10/10/2003		X	210 W MARINE DR, ASTORIA
CLAT	51811	54928	DION	W	6	15	7	10/10/2003		X	210 W MARINE DR, ASTORIA
CLAT	51812	54937	DION	W	6	15	7	10/10/2003		X	210 W MARINE DR, ASTORIA
CLAT	51813	61725	DION	W	6	15	7	10/10/2003		X	210 W MARINE DR, ASTORIA
CLAT	51814	63023	DION	W	6	15	7	10/10/2003		X	210 W MARINE DR, ASTORIA
CLAT	51819			G		61.5		8/5/2003	X	X	352 INDUSTRY WAY
CLAT	51820			G		61.5	12	8/5/2003	X	X	352 INDUSTRY WAY
CLAT	51821			G		101.5		8/7/2003	X	X	352 INDUSTRY WAY
CLAT	51822			G		81.5		8/8/2003	X	X	352 INDUSTRY WAY
CLAT	51823			G		25		7/30/2003	X	X	1 PORTWAY ST
CLAT	51824			G		25		7/30/2003	X	X	1 PORTWAY ST
CLAT	51828			G		25		7/29/2003	X	X	400 INDUSTRY ST
CLAT	51829			G		30		7/29/2003	X	X	400 INDUSTRY ST
CLAT	51895			M				12/19/2003		X	256 MARINE DR
CLAT	51896	63020		M				12/19/2003		X	256 MARINE DR
CLAT	51897	68001		M	9	15.25	9	12/19/2003	X		256 MARINE DR
CLAT	51898	68002		M		22		12/19/2003	X		256 MARINE DR
CLAT	52004		KIM	G		12	10	5/6/2004	X	X	59 W MARINE DR

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WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	52005		KIM	G		12	10	5/6/2004	X	X	59 W MARINE DR
CLAT	52006		KIM	G		12	10	5/6/2004	X	X	59 W MARINE DR
CLAT	52100			G		11		9/23/2004	X	X	
CLAT	52117			G		15		9/21/2004	X	X	
CLAT	52122			G		15		9/22/2004	X	X	
CLAT	52123			G		15		9/22/2004	X	X	
CLAT	52125			G		15		9/22/2004	X	X	
CLAT	52126			G		15		9/22/2004	X	X	
CLAT	52162			G		12		9/17/2001	X	X	495 MARINE DR
CLAT	52168			G		30		11/1/2004	X	X	1 PORTWAY
CLAT	52169			G		30		11/1/2004	X	X	1 PORTWAY
CLAT	52170			G		30		11/1/2004	X	X	1 PORTWAY
CLAT	52171			G		40	15	11/1/2004	X	X	1 PORTWAY
CLAT	52172			G		60	15	11/1/2004	X	X	1 PORTWAY
CLAT	52203			G		40	15	1/19/2005	X	X	310 INDUSTRY ST
CLAT	52204			G		40	15	1/19/2005	X	X	310 INDUSTRY ST
CLAT	52346			G		25	15	8/5/2005	X	X	490 INDUSTRIAL
CLAT	52347			G		25	15	8/5/2005	X	X	490 INDUSTRIAL
CLAT	52348			G		25	15	8/5/2005	X	X	490 INDUSTRIAL
CLAT	52349			G		25	15	8/5/2005	X	X	490 INDUSTRIAL
CLAT	52350			G		25	15	8/5/2005	X	X	490 INDUSTRIAL
CLAT	52422			G		7		8/17/2005	X		10 5TH ST, ASTORIA
CLAT	52423			G		7		8/17/2005	X		10 54TH ST, ASTORIA
CLAT	52424			G		6		8/18/2005	X		10 5TH ST, ASTORIA
CLAT	52425			G		3		8/18/2005	X		10 5TH ST, ASTORIA
CLAT	52426			G		3		8/17/2005	X		10 5TH ST, ASTORIA
CLAT	52427			G		6		8/17/2005	X		10 5TH ST, ASTORIA
CLAT	52428			G		3		8/17/2005	X		10 5TH ST, ASTORIA
CLAT	52429			G		3		8/17/2005	X		10 5TH ST, ASTORIA
CLAT	52430			G		7.5		8/18/2005	X		10 5TH ST, ASTORIA

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WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 7 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Last Name	Log Type	Detph to Water	Depth Drilled	Static Water	Date Completed	Work New	Work Abandonment	Well Address
CLAT	52443			G		90	0	12/2/2005	X	X	N OF BORING 1, ASTORIA; ON RIVER
CLAT	52444			G		80	0	12/1/2005	X	X	N OF BORING 1, ASTORIA; ON RIVER
CLAT	52445			G		80	0	11/30/2005	X	X	N OF BORING 1, ASTORIA; ON RIVER
CLAT	52446			G		95	15	11/21/2005	X	X	BETWEEN 5TH AND 6TH, ASTORIA; RR ROW ON RIVEI
CLAT	52464		TEADTKE	G		30		2/3/2006	X	X	144 DUANE ST, ASTORIA, OR 97103
CLAT	52568			G		45	10	8/11/2006	X	X	7TH AND RIVERWALK, ASTORIA
CLAT	52569			G		85	8	8/11/2006	X	X	7TH AND RIVERWALK, ASTORIA

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WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 12 T8N R10W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Log Type	First Water	Depth Drilled	Static Water	Complete Date	Work New	Work Abandonment	Well Address
CLAT	414		M	0	0	0	3/31/1994		X	490 W MARINE DR, ASTORIA
CLAT	415		M	0	0	0	3/31/1994		X	490 W MARINE DR, ASTORIA
CLAT	416		M	0	0	0	3/31/1994		X	490 W MARINE DR, ASTORIA
CLAT	417		M	0	0	0	3/31/1994		X	490 W MARINE DR, ASTORIA
CLAT	461		M	5	20	5	11/10/1994	X		
CLAT	462		M	5	20	5	11/10/1994	X		
CLAT	463		M	5	20	5	11/10/1994	X		
CLAT	464		M	5	25	5	11/11/1994	X		
CLAT	465		M	5	20	5	11/11/1994	X		
CLAT	468		M	6	20	6	11/30/1994	X		
CLAT	469		M	6	20	6	12/1/1994	X		
CLAT	470		M	6	20	6	12/1/1994	X		
CLAT	471		M	6	20	6	12/1/1994	X		
CLAT	472		M	6	34	6	12/1/1994	X		
CLAT	501		M	7	30	7	3/3/1995	X		
CLAT	502		M	7	20	7	3/3/1995	X		
CLAT	503		M	7	20	7	3/3/1995	X		
CLAT	50226		G			9	10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50225		G				10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50224		G				10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50223		G			6.4	10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50222		G			8.9	10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50221		G				10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50220		G				10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50219		G				10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50218		G			7.1	10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50217		G				10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50216		G				10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50215		G			11.3	10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50214		G				10/1/1996	X	X	585 HAMBURG, ASTORIA

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WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 12 T8N R10W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Log Type	First Water	Depth Drilled	Static Water	Complete Date	Work New	Work Abandonment	Well Address
CLAT	50213		G				10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50212		G				10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50211		G			6.2	10/1/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50210		G				10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50209		G			5.4	10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50208		G			7.5	10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50207		G				10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50206		G				10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50205		G				10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50204		G				10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50203		G			8	10/2/1996	X	X	585 HAMBURG, ASTORIA
CLAT	50426	20903	M	19	40	19.4	12/8/1997	X		460 W MARINE
CLAT	51536		G		20		8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51537		G		20		8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51538		G		20		8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51539		G		12	4.1	8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51541		G		12	4.1	8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51542		G		12	4.1	8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51543		G		12	4.1	8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51544		G		12	4.1	8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51545		G		28		8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51546		G		24	4.1	8/22/2002	X	X	MCCALL OIL BULK PLANT
CLAT	51708		G		50		4/30/2003	X	X	INTERSECTION OF HWY 101 & HUMBURG ST, ASTORIA
CLAT	51709		G		25		4/30/2003	X	X	INTERSECTION OF HWY 101 AND HUMBURG ST, ASTORIA
CLAT	51710		G		25		4/30/2003	X	X	INTERSECTION OF HWY 101 AND HUMBURG ST, ASTORIA
CLAT	51754	58661	M	10	15	10	8/23/2003	X		INDUSTIRAL ST; NEAR HAMBURG ST
CLAT	51755	58660	M	10	17	10	8/28/2003	X		LOT ON INDUSTRIAL ST; NEAR HAMBURG ST

TABLE J-3

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 12 T8N R10W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Log Type	First Water	Depth Drilled	Static Water	Complete Date	Work New	Work Abandonment	Well Address
CLAT	51756	58659	M	10	15	10	8/28/2003	X		INDUSTRIAL ST; NEAR HAMBURG ST
CLAT	51757	58674	M	10	15	10	9/5/2003	X		INDUSTRIAL ST
CLAT	51758	58673	M	10	15	10	9/4/2003	X		INDUSTRAIL ST; LOT
CLAT	51759	58672	M	10	15	10	9/4/2003	X		INDUSTRIAL ST; LOT NEAR MCCALL OIL SITE
CLAT	51760	58671	M	10	15	10	9/4/2003	X		INDUSTRIAL ST; LOT NEAR HAMBURG ST
CLAT	51763	58664	M	10	15	10	9/2/2003	X		PORTWAY; NEAR HAMBURG ST
CLAT	51764	58663	M	10	15	10	9/1/2003	X		PORTWAY; NEAR HAMBURG ST
CLAT	51770	58655	M	10	15	10	8/27/2003	X		PORTWAY AND INDUSTRIAL ST
CLAT	51771	58656	M	10	17	10	8/27/2003	X		PORTWAY AND INDUSTRIAL
CLAT	51772	58657	M	10	15	10	8/27/2003	X		INDUSTRIAL ST; NEAR HAMBURG ST
CLAT	51773	58658	M	10	15	10	8/28/2003	X		LOT ON INDUSTRIAL ST; NEAR HAMBURG ST
CLAT	51774	58651	M	10	15	10	8/26/2003	X		PORTWAY AND INDUSTRIAL ST
CLAT	51775	58652	M	10	15	10	8/26/2003	X		PORTWAY AND INDUSTRIAL ST
CLAT	51776	58653	M	10	15	10	8/27/2003	X		PORTWAY AND INDUSTRIAL ST
CLAT	51777	58654	M	10	15	10	8/27/2003	X		PORTWAY AND INDUSTRIAL ST
CLAT	52098		G		15.5		9/21/2004	X	X	
CLAT	52099		G		15		9/23/2004	X	X	
CLAT	52101		G		15		9/22/2004	X	X	
CLAT	52102		G		15		9/21/2004	X	X	
CLAT	52103		G		15		9/21/2004	X	X	
CLAT	52104		G		15		9/21/2004	X	X	
CLAT	52105		G		15		9/21/2004	X	X	
CLAT	52106		G		15		9/21/2004	X	X	
CLAT	52107		G		15		9/21/2004	X	X	
CLAT	52108		G		15		9/21/2004	X	X	
CLAT	52109		G		15		9/21/2004	X	X	
CLAT	52110		G		15		9/21/2004	X	X	
CLAT	52111		G		15		9/21/2004	X	X	

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WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 12 T8N R10W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Log Type	First Water	Depth Drilled	Static Water	Complete Date	Work New	Work Abandonment	Well Address
CLAT	52112		G		15		9/21/2004	X	X	
CLAT	52113		G		15		9/23/2004	X	X	
CLAT	52114		G		15		9/21/2004	X	X	
CLAT	52115		G		15		9/21/2004	X	X	
CLAT	52116		G		15		9/21/2004	X	X	
CLAT	52118		G		15		9/21/2004	X	X	
CLAT	52119		G		15		9/22/2004	X	X	
CLAT	52120		G		15		9/22/2004	X	X	
CLAT	52121		G		15		9/22/2004	X	X	
CLAT	52124		G		15		9/22/2004	X	X	
CLAT	52127		G		15		9/22/2004	X	X	
CLAT	52128		G		15		9/23/2004	X	X	
CLAT	52129		G		15		9/22/2004	X	X	
CLAT	52130		G		15		9/22/2004	X	X	
CLAT	52131		G		15		9/23/2004	X	X	
CLAT	52132		G		14		9/23/2004	X	X	
CLAT	52407	79843	M	11.5	17	11.5	9/15/2005	X		PIER 2; PORT OF ASTORIA
CLAT	52408	79844	M	11.3	17	11.3	9/15/2005	X		PIER 2; PORT OF ASTORIA
CLAT	52409	79845	M	8.1	15	8.1	9/15/2005	X		PIER 2; PORT OF ASTORIA
CLAT	52515		M		15		2/6/2006		X	LOT ON INDUSTRIAL ST
CLAT	52516	58673	M		15		2/6/2006		X	LOT ON INDUSTRIAL ST
CLAT	52519	58671	M		15		2/6/2006		X	INDUSTRIAL ST
CLAT	52629	58664	M		16.8		12/7/2006		X	1 PORTWAY, ASTORIA, OR 97103
CLAT	52630	58659	M		14.4		12/7/2006		X	1 PORTWAY

TABLE J-4

WELL LOG INVENTORY - OWRD GRID SEARCH RESULTS
SECTION 18 T8N R9W

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

County	Well Nbr	Well Tag	Name Last	Type	First Water	Depth Drilled	Static Water	Complete Date	Work New	Work Abandonment	Work Alteration	Well Address
CLAT	292			W		350		8/26/1985	X			MARINE DR (TAYLOR AVE) & FRANKFERT
CLAT	496			M	3	15	3.4	2/6/1995	X			
CLAT	507			M	5	17	3.5	2/7/1995	X			
CLAT	50595		BIRDWELL	G		12	11.5	8/24/1998	X	X		710 W MARINE DR
CLAT	50596		BIRDWELL	G		12		8/24/1998	X	X		710 MARINE DR
CLAT	50597		BIRDWELL	G		16	10.3	8/24/1998	X	X		710 W MARINE DR
CLAT	50598		BIRDWELL	G		16		8/24/1998	X	X		710 W MARINE DR
CLAT	50602		BIRDWELL	G		12		8/24/1998	X			710 W MARINE DR
CLAT	50604		BIRDWELL	G		16	11.2	8/25/1998	X	X		710 W MARINE DR
CLAT	50605		BIRDWELL	G		12	11.6	8/24/1998	X	X		710 W MARINE DR
CLAT	51092		WOLCOTT	G		16	13.7	11/27/2000	X			783 W MARINE DR, ASTORIA
CLAT	51093		WOLCOTT	G		20	12.8	11/27/2000	X			783 W MARINE DR, ASTORIA
CLAT	51094		WOLCOTT	G		16	13.4	11/27/2000	X			783 W MARINE DR, ASTORIA
CLAT	51147			G		36		3/9/2001		X		1001 W MARINE DR
CLAT	51148			G		41	18	3/9/2001	X	X		1001 W MARINE DR
CLAT	51192	26568		M				8/21/2001			X	1224 MARINE DR, ASTORIA
CLAT	51193	26567		M				8/21/2001			X	1224 MARINE DR, ASTORIA
CLAT	51194	26566		M				8/21/2001			X	1224 MARINE DR, ASTORIA
CLAT	51212	51464		M	9	16	9	8/21/2001	X			1224 MARINE DR
CLAT	51213	51465		M	9	16	9	8/21/2001	X			1224 MARINE DR
CLAT	51214	51466		M	9	16	9	8/21/2001	X			1224 MARINE DR
CLAT	51215	51467		M	4	15	4	8/21/2001	X			1224 MARINE DR
CLAT	51216	51468		M	4	14	4	8/21/2001	X			1224 MARINE DR
CLAT	51228	52675		M	10	16	10	9/14/2001	X			1224 MARINE DR
CLAT	51229	52676		M	10	17	10	9/14/2001	X			1244 MARINE DR
CLAT	52455			G		60		1/10/2006	X	X		985 BRIDGE VIEW COURT
CLAT	52456			G		25		1/12/2006	X	X		985 BRIDGE VIEW COURT
CLAT	52457			G		60		1/13/2006	X	X		985 BRIDGE VIEW COURT
CLAT	52458			G		30		1/16/2006	X	X		985 BRIDGE VIEW COURT
CLAT	52520	82738		M		25		1/11/2006	X			985 BRIDGEVIEW COURT
CLAT	52521	82739		M		30		1/11/2006	X			985 BRIDGEVIEW COURT